U.S. Army Center for Health Promotion and Preventive Medicine

INJURY PREVENTION REPORT NO. 12-HF-05WC-07
INJURY PREVENTION EFFECTIVENESS OF MODIFICATIONS OF SHOE TYPE ON INJURIES AND RISK FACTORS ASSOCIATED WITH PAIN AND DISCOMFORT IN THE U.S. ARMY BAND
FORT MEYER, VIRGINIA
2007-2008

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14. ABSTRACT

Footwear characteristics can have an influence on fatigue, overuse injuries and comfort. Shoes are an important consideration for members of the US Army Band who may perform hundreds of missions a year. These missions often include prolonged standing, marching, and can be conducted in unfavorable weather conditions. In a previous investigation, over 50% of the band members noted problems with their footwear such as lack of cushioning, support and breathability. In an effort to reduce injuries and improve comfort, one to two pairs of shoes with a presumed increase in cushioning and ventilation were provided to the band members (n=112) to wear for one year. Participant demographic and lifestyle data were collected from existing databases and a questionnaire. The McNemar test was used to compare injury incidence 1 year prior to receiving the shoes and 1 year after receiving the shoes. Potential risk factors for self-reported foot, knee, and back pain, numbness or discomfort attributed to band activities were explored using logistic regression. There were no differences in injury incidence one year before receiving the new shoes versus the year in which the band members wore the new shoes. Being assigned to the ceremonial group, poor shoe cushioning, wearing orthotics and those who replaced their shoes more frequently were associated with a higher risk of foot pain and discomfort; a poor fit in the heel was associated with a higher risk of knee pain and discomfort; marching for longer periods of time, performing other physical activities 5-7 days a week, poor shoe cushioning and reported feet too warm in hot weather was associated with a higher risk of back pain and discomfort. Combining the specific shoe characteristic ratings into groups revealed that approximately a quarter of the band members rated the fit of the shoes as poor and approximately one third rated comfort characteristics as poor. The new shoes did not reduce injury incidence and it is not recommended that the band switch to this shoe. To increase the amount of cushioning in the shoe and potentially decrease foot and back pain insoles should be further investigated in the Army band.

15. SUBJECT TERMS
Comfort ,pain, shoe fit, musculoskeletal, military

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EXECUTIVE SUMMARY
INJURY PREVENTION REPORT NO. 12-HF-05WC-07
INJURY PREVENTION EFFECTIVENESS OF MODIFICATIONS OF SHOE TYPE ON INJURIES AND RISK FACTORS ASSOCIATED WITH PAIN AND DISCOMFORT IN THE U.S. ARMY BAND FORT MEYER, VIRGINIA 2007-2008

1. INTRODUCTION. Footwear characteristics influence fatigue, overuse injuries, and comfort. Footwear is especially important to members of the U.S. Army Band who may perform hundreds of missions a year. These missions often include prolonged standing, and marching and can be conducted in unfavorable weather conditions during the summer and winter months. In a previous epidemiological investigation examining the U.S. Army Band, over 50 percent of the band members noted problems with their footwear as well as in 5 of 11 focus groups. They suggested that replacing their current shoes with more appropriate shoes might reduce problems. The purpose of this paper is to examine: (1) injury rates before and after wearing a shoe with a presumed increase in cushioning and ventilation for 1 year,(2) risk factors associated with musculoskeletal symptoms, and (3) comfort of the shoes.

2. METHODS.

a One or two pairs of shoes with presumed improved ventilation and cushioning properties were purchased for each band member in the Blues, Ceremonial, Chorus, and Concert units. The band members wore these shoes for approximately 1 year from July 2007 to August 2008. The shoes were Bates Durashocks® which possess some favorable properties such as outsoles that have built in compression pads in the heel and forefoot, and Cooltech®. Cooltech theoretically improves breathability by increasing ventilation through eyeleted vent holes on the sides of the shoes. (Durashocks® and Cooltech® are registered trademarks of Wolverine World Wide, Inc.)

b. The Armed Forces Health Surveillance Center (AFHSC) provided visit dates and International Classification of Disease 9th Revision (ICD-9) codes for all outpatient medical encounters occurring between 01 July 2006 and 30 June 2007 and between 01 July 2007 and 30 June 2008. These dates encompassed the 1-year period before the shoes were provided to the band and the 1-year period while Soldiers wore the new shoes. Lower-extremity-overuse injuries were determined from this data. The AFHSC also provided demographic data (education level, marital status, race, and gender) compiled from the Defense Manpower Data Center (DMDC). Band members completed a questionnaire asking them about playing their instrument and performing, shoe characteristics, exercise and sports, tobacco use, medical problems, and medical care. The most recent of the semiannual Army Physical Fitness Test

(APFT) scores (push-up, sit-up and 2-mile run performances) were obtained directly from the band.

c. The McNemar test was used to examine injuries in the same group of subjects 1 year prior to receiving the Bates Durashocks and 1 year after receiving the Bates Durashocks. Potential risk factors for the lower-extremity-overuse injuries were explored using univariate and multivariate Cox Regression (a survival analysis technique). Hazard ratios and 95 percent confidence intervals (CI) were calculated for each risk factor. Potential risk factors for self-reported foot, knee and back pain, numbness, or discomfort attributed to band activities were explored using univariate and multivariate logistic regression. Odds ratios and 95 percent CIs were calculated for each risk factor. Variables with high collinearity were removed from the multivariate model.

3. RESULTS. The McNemar test revealed no differences in injury incidence before versus after receiving the Bates Durashocks. Lower-extremity-overuse injury incidence was 28 percent before and 37 percent after wearing the Bates Durashocks (p=0.17). Soldiers who reported that their feet became too cold in cold weather had a higher risk of a training related injury. Being assigned to the ceremonial group, poor shoe cushioning, wearing orthotics, and those who replaced their shoes more frequently were associated with a higher risk of foot pain and discomfort; a poor fit in the heel was associated with a higher risk of knee pain and discomfort; marching for longer periods of time, performing other physical activities 5–7 days a week, poor shoe cushioning, and reporting feet too warm in hot weather was associated with a higher risk of back pain and discomfort. About two fifths (39–45 percent) of the band members rated the fit characteristics of the Bates Durashocks as good, one third (27–34 percent) rated its comfort characteristics as good, and about two fifths (38–43 percent) rated its durability and style characteristics as good. When comparing the various characteristics of the Bates Durashocks to their previous band shoes about one fifth (17–21 percent) preferred the Bates Durashocks for fit characteristics, one third (28–35 percent) for comfort characteristics, and one fifth (15–19 percent) for durability and style.

4. DISCUSSION

a. There were no differences in injury incidence before and after wearing the Bates Durashocks. The presumed increase in shock attenuation and cushioning properties of the Bates Durashocks had no effect on injury incidence before or after wearing the Bates Durashocks.

b. A reported poor fit in the heel was associated with pain and discomfort of the knees. A poor fit of the heel could be associated with: (1) the heel sliding out of the shoe during heel-off as a result of the heel being positioned too high in relation to the topline or collar of the shoe, or (2) a lack of flexibility in the shoe. The Bates Durashock may lack flexibility as a result of the Goodyear welt construction (sewn), which is much less flexible than a cement (adhesive)

construction. When obtaining the proper fit of a shoe, there should be a snug fit around the heel. In certain shoes, the counter (the rounded back area of the shoe supporting the heel) is extended on the medial side of the shoe to resist the tendency of the foot to pronate. Without adequate heel counter control (due to a poor fit or broken down counter), rearfoot kinematics may be altered, leading to knee pain and discomfort.

c. Overall, about a third of the band members rated the comfort and about a quarter rated the fit characteristics of the Bates Durashocks as poor. In the previous U.S. Army Band study, 53 percent of the band members noted problems with their current footwear. For the current and previous study, band members reporting a poor fit of their footwear may not have selected shoes of appropriate length and width. In a study involving infantry recruits, it was found that recruits compensated for lack of available shoe widths by choosing larger shoes. In the current study, 24 percent of the band members reported the width of the Bates Durashocks as poor. It is possible that those who may have selected a larger shoe due to wide feet would then experience a poor fit of the shoe and rate it as less comfortable.

5. RECOMMENDATIONS. The Bates Durashocks has no advantage over the standard shoe in reducing injury incidence. It is not recommended that the band switch to this shoe. To increase the amount of cushioning in the shoe and potentially decrease foot and back pain, insoles should be further investigated in the U.S. Army Band.

TABLE OF CONTENTS

PAGE

List of Tables

USACHPPM Epidemiological Report No. 12-HF-05WC-07

INJURY PREVENTION REPORT NO. 12-HF-05WC-07
INJURY PREVENTION EFFECTIVENESS OF MODIFICATIONS OF SHOE TYPE ON INJURIES AND RISK FACTORS ASSOCIATED WITH PAIN AND DISCOMFORT IN THE U.S. ARMY BAND FORT MEYER, VIRGINIA 2007-2008

1. REFERENCES. Appendix A contains the references used in this report.

2. AUTHORITY. Under Army Regulation (AR) 40-5[1] (paragraph 2-19), the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) is responsible for supporting Army preventive medicine activities, to include interpretation of surveillance data, identification of leading health problems, and assistance in prevention and control of leading health problems. This project was funded in Fiscal Year 2007 by the Health Promotion and Prevention Initiatives (HPPI) Program as Project #8. The HPPI initiatives in the U.S. Army Medical Department are funded by the Office of the Assistant Secretary of Defense for Health Affairs. This project was directed at reducing injuries and pain, as well as increasing comfort among members of the U.S. Army Band.

3. INTRODUCTION.

a. Footwear characteristics can influence fatigue[2], overuse injuries[3], and comfort[4]. Footwear is especially important to members of the U.S. Army Band who may perform hundreds of missions a year. These missions often include prolonged standing, marching, and can be conducted in unfavorable weather conditions during the summer and winter months. In a previous epidemiological investigation examining the U.S. Army Band, over 50 percent of the band members noted problems with their footwear; in 5 of 11 focus groups conducted, it was suggested that replacing their current shoes with more appropriate shoes would reduce problems. Soldiers noted that their shoes lacked in cushioning, support, and flexibility; the shoes didn't appear to be designed for marching or standing and were extremely uncomfortable in hot weather. When asked the open-ended question concerning what changes they would recommend, 35 of the 152 respondents (23 percent) suggested more comfortable/supportive shoes[5].

b. As a result of the previous investigation, efforts were made to improve the footwear of the band members. Bates Durashocks® were purchased and provided to selected band members or those who spent more time on their feet. The Bates Durashocks were chosen because they possess some favorable properties such as outsoles that have built in compression pads in the heel and forefoot, and Cooltech® which presumably improves breathability by increasing ventilation through eyeleted vent holes on the sides of the shoes. The purpose of this paper is to examine: (1) injury rates before and after wearing a shoe with a presumed increase in cushioning

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and ventilation for one year, (2) risk factors associated with musculoskeletal symptoms, and (3) comfort of the shoes. (Bates Durashocks® and Cooltech® are registered trademarks of Wolverine World Wide, Inc.)

4. BACKGROUND LITERATURE.

a. Footwear and Injuries. In a previous band investigation, the incidence of lower-extremity-overuse injury was 37 percent and 40 percent in 2004 and 2005, respectively. One of the recommendations of that investigation was to provide appropriate shoes for band activities[5]. In a study examining footwear of newspaper carriers with lower-overuse injuries (all of whom walk at least 3 kilometers (km) or climb at least 100 floors on their daily paper routes), the newspaper carriers were randomly assigned to footwear with good shock-absorbing properties or used their own footwear. At the 6-month follow-up, those who received the new footwear tended to report less lower limb pain and fewer painful days when compared with the group who wore their own shoes[6]. In another study investigating the age of running shoes and stress fractures, investigators found that Marine recruits who reported that their shoes were 6 months to 1 year old were 2.3 times more likely to experience a stress fracture in training compared with those who reported their shoes were less than 1 month old. Investigators suggested that the age of the shoe may have an impact on the degree to which shock absorbency and mechanical support were lost[7].

b. Footwear and Musculoskeletal Discomfort.

(1) The U.S. Army Band spends many hours standing at performances, rehearsals, and practices. The amount of time standing, along with unsupportive shoes, could be associated with musculoskeletal pain and discomfort of the feet as well as discomfort and fatigue of the lower extremities and back. Musculoskeletal discomfort of the lower extremities and back has been associated with prolonged standing[8, 9, 10, 11, 12]. In a footwear study of clinical nurses, investigators evaluated three brands of commercially available nursing shoes in an effort to reduce lower-extremity discomfort due to prolonged periods of standing and walking. They concluded that a footbed with arch support assisted in the distribution of arch pressure and reduced muscle fatigue in the calf. The shoe they recommended had an outsole and midsole made out of ethylene vinyl acetate (EVA) and an arch support system[4].

(2) The U.S. Army Band also performs marching as part of its ceremonies. Skeletal shock from repeated impact of the foot against hard surfaces which occurs during marching can cause pain and overuse injuries in the feet, ankles, knees, and back[13]. Studies examining normal gait found that at heel strike, bone vibrations occur at 25 to 100 cycles per second[14]. Shock absorbers within the body (meniscus, intervertebral disc, bone) presumably absorb and dissipate this energy. Viscoelastic insoles have been shown to reduce shockwaves induced during gait by 42 percent[14]. Insoles placed into shoes have also been shown to reduce mean

peak pressure during heel strike and forefoot landing[15]. For musculoskeletal pain and discomfort, some studies have shown that insoles increased comfort[11, 16, 17, 18, 19] and decreased injuries[20]; whereas, other studies have shown no changes in musculoskeletal discomfort[7, 21, 22]. It may be possible that a shoe with increased cushioning may also decrease musculoskeletal pain and discomfort.

c. Footwear Comfort. Comfort (a state of being relaxed and feeling no pain) is important in the design of shoes. It is subjective, yet easily determined. In a study investigating subjective comfort of three athletic shoes, investigators found that the shoe with the most flexibility and highest arch and toe box were rated the most comfortable for standing and walking[23]. In another study investigating perceived comfort and pressure distribution in casual footwear, researchers examined plantar and dorsal pressure for a "comfortable" group and an "uncomfortable" group as determined by a "perception of comfort" questionnaire. The uncomfortable group had higher peak pressure over the total plantar surface and in each region of the foot (rearfoot medial, rearfoot lateral, midfoot medial, midfoot lateral, forefoot medial, and forefoot lateral). For the dorsal surface area, maximal force was also greater for the uncomfortable group[24]. They suggested that pressure measurements could be used in an attempt to improve the comfort of footwear.

5. METHODS.

a. Project Design. One to two pairs of shoes were purchased for each band member in the Blues, Ceremonial, Chorus, and Concert units. Men received the Bates Durashocks Uniform Oxford Style 1301 shoes. Women received the Bates Durashocks Uniform Oxford Style 742 shoes. In the previous band study, shoes were cited as lacking in general support, in arch support, in cushioning, in flexibility, were considered too hot in warm weather, and poorly designed for prolonged standing and marching. The Bates Durashocks possessed Cooltech which would theoretically increase the breathability of the shoe, as well as the Durashock technology consisting of outsoles with built in compression pads in the heel and forefoot (claiming to keep your feet comfortable when standing still for hours or parading). The band members wore these shoes for approximately 1 year, from July 2007 to August 2008. At the end of that period they were administered a questionnaire, and injuries and demographics were obtained from the Armed Forces Health Surveillance Center (AFHSC) as described below.

b. Participants. Participants were Service members in the U.S. Army Band ("Pershing's Own") garrisoned at Fort Myer, Virginia. There were 157 band members who received the Bates Durashocks and completed the survey. Officers (n= 4) were removed from the study because their tasks differed from most of the band members. Also removed were those who reported wearing the Bates shoes for 40 percent or less of the time (n=41) for all three events (rehearsals, practices and performances). If they wore the Bates Durashocks for more than 40

percent of the time for at least one event, they were included. The final group consisted of 112 band members. Table 1 shows the proportion of the time the Bates Durashocks were worn.

Table 1. Percentage of Time the Bates Durashocks® Were Worn for Practices, Rehearsals, and Performances

Percent of Time Shoes Worn	Practices		Rehearsals		Performances	
	n	%	n	%	n	%
0–40%	48	43	47	42	0	0
50–90%	18	16	21	19	27	24
100%	43	38	41	37	85	76
Missing	3	3	3	3	0	0

c. Questionnaires.

(1) At the end of the project, band members were asked to complete a questionnaire similar to one used in the previous epidemiological investigation of this group[5]. Questionnaire items were slightly modified to remove items that had not been deemed useful in the previous project, and the section on shoes was expanded. Two slightly different questionnaires were administered: one for instrumentalists and one for vocalists (see Appendices B and C). Each questionnaire took about 20 minutes to complete.

(2) The questionnaires asked the participants about playing their instrument and performing (which included time spent standing and marching), shoes, exercise and sports, tobacco use, and medical problems and medical care.

d. Army Physical Fitness Test Scores. Scores from each band member's most recent Army Physical Fitness Test (APFT) were obtained directly from the U.S. Army Band. The APFT consists of three events: a 2-minute maximal effort push-up event, a 2-minute maximal effort sit-up event, and a 2-mile run performed for time. In the push-up event, the subject lowered his/her body in a generally straight line to a point where his/her upper arm was parallel to the ground and then returned to the starting point with elbows fully extended. In the sit-up event, the subject's knees were bent at a 90 degree (°) angle, fingers were interlocked behind the head, and a second person held the subject's ankles, keeping his or her heels firmly on the ground. The subject raised his/her upper body to a vertical position so that the base of the neck was anterior to the base of the spine and then returned to the starting position. Scores were the number of push-ups and sit-ups successfully completed within the separate 2-minute time periods. The performance measure for the run was the time taken to complete the 2-mile distance. Time between events was no less than 10 minutes.

e. Injury Outcome Measures and Demographics.

(1) A list of participants was provided to the AFHSC. The AFHSC returned visit dates and the International Classification of Disease 9th Revision (ICD-9) codes for all outpatient medical encounters occurring between 01 July 2006 and 30 June 2007 and between 01 July 2007 and 30 June 2008. The first four diagnoses from each visit were obtained, even though a single visit usually indicated only one diagnosis. Five injury indices consisting of specific sets of ICD-9 codes were analyzed: the Installation Injury Index (III), the Modified Installation Injury Index (MIII), the Training Related Injury Index (TRII), the Comprehensive Injury Index (CII), and the Overuse Injury Index (OII).

(2) The III was developed by personnel at the AFHSC. It has been used to compare injury rates among military posts and is reported on a monthly basis at the AFHSC website (http://afhsc.army.mil). The MIII, TRII, CII, and OII were developed by personnel in the Injury Prevention Program at the USACHPPM. The MII captures a greater number of injuries more than the III, including more overuse type injuries. The TRII is limited to lower-extremity-overuse injuries and has been used to compare injury rates among basic training posts[3]. The CII captures all ICD-9 codes related to injuries. The OII captures the subset of musculoskeletal injuries presumably resulting from cumulative microtrauma (overuse-type injuries). It includes such diagnoses as stress fractures, stress reactions, tendonitis, bursitis, facsciitis, arthralgia, neuropathy, radiculopathy, shin splints, synovitis, strains, and musculoskeletal pain (not otherwise specified).

(3) The AFHSC also provided demographic data from the Defense Manpower Data Center (DMDC). Demographics included education level, marital status, race, and gender. The U.S. Army Band provided date of birth, height, weight, and the Soldiers functional group (ceremonial, concert, chorus, and blues).

f. Data Analysis.

(1) The Statistical Package for the Social Sciences (SPSS®), Version 16.0, was used for statistical analysis. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared (kg/m^2). Descriptive statistics (frequencies, distributions, means, standard deviation (SD)) were calculated for demographics including age, BMI, race, marital status, educational level, functional group, tobacco use variables, marching time, standing time, APFT scores, sports and exercise participation, and shoe characteristics. (SPSS® is a registered trademark of SPSS Corporation.)

(2) The McNemar test was used to compare injury incidence in subjects over the year before receiving the Bates Durashocks and the year after receiving the Bates Durashocks for all five injury indices. For each of the two periods, injury incidence was calculated as—

$$(\text{Number of Soldiers with} \geq 1 \text{ injury} / \sum \text{all band members}) \times 100\%$$

(3) Potential risk factors for injuries were explored using Cox regression, a survival analysis technique. The TRII was selected as the outcome measure because it is limited to lower-extremity-overuse injuries, which were those most likely to be affected by the shoes. Hazard ratios and 95 percent confidence intervals (CIs) were calculated for each potential risk factor (independent variables). Potential risk factors included questionnaire variables, physical fitness measures, and demographics. For each analysis, once a subject had an injury, his/her contribution to time at risk was terminated. All covariates were entered into the regression model as categorical variables.

(4) Potential risk factors for self-reported pain, numbness, or discomfort in the foot, knee, or back attributed to band activities were explored using logistic regression. Univariate logistic regression was performed with foot, knee and back pain, numbness, or discomfort as separate health outcome variables. Odds ratios (OR) and 95 percent CIs were calculated for each risk factor (independent variables). Risk factors from the univariate analysis with $p<0.05$ were selected for backward-stepping multivariate logistic regression. A value of $p<0.05$ was required to be retained in the model unless a diagnostic test showed collinearity. Variables with high collinearity were removed from the model. Multivariate odds ratios and 95 percent CIs were calculated.

(5) For the shoe characteristics on the questionnaire, a rating scale of 1–10 was used to measure specific shoe characteristics, then collapsed into three categories: 1–4 were reclassified as poor fit, 5 as acceptable fit, 6–10 as good fit. For the comparison of the Bates Durashocks with the previous band shoe, a scale of 1–10 was also used and again collapsed into three categories: 1–4 indicated that Bates Durashocks were preferred over previous band shoes, 5 indicated no difference between the shoes, and 6–10 indicated that the previous shoe was preferred over the Bates Durashocks.

6. RESULTS.

a. Descriptive Statistics.

(1) Table 2 shows the distribution of demographics; tobacco use; and average time standing, and marching. A majority of the band members were married, Caucasian men, who were college graduates, with an age (mean ± SD) of 41 ± 8 years. Only one band member reported using tobacco products (cigarettes). A little less than a quarter of the band members reported an average marching time of greater than 2 hours, and almost half the band members reported an average standing time of greater than 2 hours.

Table 2. Distribution of Characteristics of US Army Band: Demographics, Tobacco Use, and Time Standing

Category	Variable	Level of Variable	n	%
Demographics	Gender	Men	96	86
		Women	16	14
	Age	25–35	37	33
		36–44	39	35
		45+	36	32
	Body Mass Index	17–23	22	20
		24–25	32	29
		26–27	27	24
		28+	31	28
	Race	Caucasian	94	84
		Asian	2	2
		Black	11	10
		Hispanic	4	4
		Unknown	1	1
	Marital Status	Married	93	83
		Single	12	11
		Other	7	6
	Education Level	High School	9	8
		Bachelors Degree	35	31
		Masters Degree	55	49
		Doctorate	4	4
		Unknown	9	8
	Functional Group	Ceremonial	38	34
		Blues	9	8
		Chorus	21	19
		Concert	44	39
Tobacco	Cigarettes	Nonsmoker	96	86
		Smoked but Quit	14	13
		Smoker	1	1
		Missing	1	1
	Smokeless Tobacco Use	None	110	98
		Quit	0	0
		Users	0	0
		Missing	2	2
Average time Marching or Standing	Standing	≤60 minutes	27	24
		61–120 minutes	33	30
		121+ minutes	51	46
		Missing	1	1
	Marching	≤60 minutes	39	35
		61–120 minutes	27	24
		121+ minutes	25	22
		Missing	21	19

(2) Table 3 shows APFT scores and exercise and physical activity. A majority of the band members performed aerobic exercise, strength training, and participated in other physical activities 2–4 times a week.

Table 3. APFT Scores, Exercise, and Sports Participation by U.S. Army Band Members

Category	Variable	Level of Variable	n	%	Mean ± SD
APFT Scores	Push-Ups (reps)	12–36	36	32	45 ± 18
		37–44	32	29	
		45+	34	30	
		Missing	10	9	
	Sit-Ups (reps)	28–44	31	28	53 ± 16
		45–50	33	30	
		51+	40	36	
		Missing	8	7	
	2-Mile Run (min)	12.95–16.05	25	22	16.7 ± 2
		16.06–17.38	25	22	
		17.39+	22	20	
		Missing	40	36	
Physical Activity	Aerobic Exercise	≤ 1 time /wk	10	9	4 ± 1
		2–4 times/wk	71	63	
		5–7 times/wk	30	27	
		Missing	1	1	
	Strength Training	≤ 1 time/wk	28	25	3 ± 2
		2–4 times/wk	73	65	
		5–7 times/wk	10	9	
		Missing	1	1	
	Sports Activities	≤ 1 time/wk	72	64	2 ± 2
		2–4 times/wk	25	22	
		5–7 times/wk	13	12	
		Missing	2	2	
	Other Physical Activities	≤ 1 time/wk	30	27	4 ± 2
		2–4 times/wk	62	55	
		5–7 timeswk	16	17	
		Missing	1	1	

b. Injury Incidence Before and While Wearing the Bates Durashocks. Table 4 shows injury incidence in the year before the Bates Durashocks were issued and the year during which the Bates Durashocks were worn. Injury incidence did not differ between the two periods for any of the injury indices.

Table 4. Comparison of Injury Incidence for Five Injury Indices Before and While Wearing the Bates Durashocks® (n=112)

Injury Index	Injury Incidence in Year Before Bates Durashocks (%)	Injury Incidence in Year Bates Durashocks Worn (%)	p-value (McNemar Test)
III	47	53	0.50
MII	51	51	0.68
TRII	28	37	0.17
CII	55	57	0.78
OII	38	41	0.64

c. Risk Factors for Injuries While Wearing the Bates Durashocks. Table 5 displays the relationship between time to the first TRII injury and the subjective ratings of the Bates Durashocks. Those reporting that their feet were too cold in cold weather were at greater risk of injury. Table 6 shows the relationship between time to the first TRII injury and band members' preference for the Bates Durashocks or the Army shoe. Preference was not associated with injury risk.

Table 5. Univariate Cox Regression: Association between the TRII and Ratings of the Bates Durashocks, Comparison of the Bates Durashocks with Previous Shoes, Environmental Conditions, Orthotics, Shoe Replacement, and Standing and Marching Time

Category	Variable	Level of Variable	n[1]	Reported Injury (%)	Hazard Ratio (95%CI)	p-value
Bates Durashocks®	Fit in Heel	Good	50	42	1.00	
		Acceptable	34	32	0.73 (0.35–1.52)	0.40
		Poor	26	35	0.82 (0.38–1.79)	0.62
	Width	Good	47	38	1.00	
		Acceptable	37	35	0.96 (0.47–1.95)	0.90
		Poor	27	37	0.97 (0.45–2.10)	0.94
	Toe Room	Good	44	34	1.00	
		Acceptable	40	38	1.19 (0.58–2.43)	0.64
		Poor	27	41	1.28 (0.59–2.78)	0.54

Table 5. Univariate Cox Regression: Association between the TRII and Ratings of the Bates Durashocks®, Comparison of the Bates Durashocks® with Previous Shoes, Environmental Conditions, Orthotics, Shoe Replacement, and Standing and Marching Time (continued)

Category	Variable	Level of Variable	n[1]	Reported Injury (%)	Hazard Ratio (95%CI)	p-value
Bates Durashocks®	Cushioning	Good	35	37	1.00	
		Acceptable	40	40	1.03 (0.50–2.14)	0.94
		Poor	36	33	0.93 (0.42–2.04)	0.85
	Flexibility	Good	38	37	1.00	
		Acceptable	38	45	1.28 (0.63–2.59)	0.50
		Poor	35	29	0.79 (0.35–1.77)	0.56
	Support	Good	30	37	1.00	
		Acceptable	45	42	1.15 (0.55–2.42)	0.71
		Poor	36	31	0.82 (0.36–1.89)	0.64
	Comfort	Good	31	36	1.00	
		Acceptable	35	49	1.37 (0.64–2.92)	0.42
		Poor	44	30	0.83 (0.37–1.85)	0.65
	Breathability	Good	31	29	1.00	
		Acceptable	34	41	1.43 (0.62–3.29)	0.41
		Poor	45	38	1.39 (0.62–3.11)	0.43
	Durability	Good	43	35	1.00	
		Acceptable	40	40	1.17 (0.58–2.36)	0.67
		Poor	28	36	1.08 (0.49–2.40)	0.85
	Style	Good	48	29	1.00	
		Acceptable	38	42	1.67 (0.82–3.43)	0.16
		Poor	21	43	1.77 (0.76–4.09)	0.18
	Overall Fit	Good	48	38	1.00	
		Acceptable	32	38	0.99 (0.47–2.05)	0.97
		Poor	30	37	1.02 (0.48–2.15)	0.97
Environmental Conditions	Feet too hot in warm weather	No	42	24	1.00	
		Yes	70	44	1.95 (0.96–3.98)	0.07
	Feet too cold in cool weather	No	53	25	1.00	
		Yes	59	48	2.15 (1.11–4.17)	0.02
Other Questions	Orthotics	No	77	38	1.00	
		Yes	35	34	0.94 (0.50–1.91)	0.94
	How Often Do You Replace Your Shoes	0–12 months	27	44	1.00	
		1–2 years	38	32	0.62 (0.28–1.37)	0.24
		>2 years	47	36	0.73 (0.35–1.53)	0.41
Time on Feet	Standing	≤ 60 min	27	37	1.00	
		61–120 min	33	39	1.08 (0.47–2.46)	0.86
		121+ min	51	33	0.88 (0.40–1.92)	0.74
	Marching	≤ 60 min	39	49	1.00	
		61–120 min	27	26	0.49 (0.20–1.16)	0.10
		121+ min	25	32	0.62 (0.27–1.41)	0.26

Note: [1] Not everyone completed all of the questions on the questionnaire.

Table 6. Univariate Cox Regression: Association between the TRII and Ratings of the Bates Durashocks versus the Previous Army Shoe

Variable	Level of Variable	n	Reported Injury (%)	Hazard Ratio (95%CI)	p-value
Fit in Heel	Preferred Bates	22	32	1.00	
	No Difference	56	38	1.26 (0.54–2.97)	0.59
	Preferred Previous Shoe	30	37	1.30 (0.50–3.34)	0.59
Width	Preferred Bates	19	26	1.00	
	No Difference	53	38	1.63 (0.61–4.35)	0.33
	Preferred Previous Shoe	36	39	1.71 (0.62–4.75)	0.30
Toe Room	Preferred Bates	24	25	1.00	
	No Difference	50	36	1.60 (0.63–4.03)	0.32
	Preferred Previous Shoe	34	44	2.11 (0.82–5.43)	0.12
Cushioning	Preferred Bates	36	39	1.00	
	No Difference	34	35	0.86 (0.40–1.85)	0.69
	Preferred Previous Shoe	38	34	0.89 (0.42–1.88)	0.75
Flexibility	Preferred Bates	31	36	1.00	
	No Difference	40	40	1.16 (0.54–2.49)	0.71
	Preferred Previous Shoe	37	32	0.92 (0.41–2.09)	0.84
Support	Preferred Bates	37	41	1.00	
	No Difference	36	33	0.73 (0.34–1.56)	0.42
	Preferred Previous Shoe	35	34	0.81 (0.38–1.73)	0.59
Comfort	Preferred Bates	39	39	1.00	
	No Difference	34	35	0.89 (0.42–1.90)	0.76
	Preferred Previous Shoe	35	34	0.86 (0.40–1.84)	0.70
Breathability	Preferred Bates	33	39	1.00	
	No Difference	39	31	0.75 (0.34–1.65)	0.47
	Preferred Previous Shoe	35	37	1.00 (0.46–2.16)	0.99
Durability	Preferred Bates	21	43	1.00	
	No Difference	52	33	0.69 (0.31–1.56)	0.38
	Preferred Previous Shoe	34	35	0.80 (0.34–1.90)	0.60
Style	Preferred Bates	17	41	1.00	
	No Difference	60	35	0.82 (0.35–1.94)	0.66
	Preferred Previous Shoe	28	36	0.88 (0.33–2.31)	0.79
Overall Fit	Preferred Bates	22	32	1.00	
	No Difference	53	38	1.23 (0.52–2.91)	0.64
	Preferred Previous Shoe	33	36	1.24 (0.49–3.14)	0.66

d. Risk Factors for Foot Pain/Discomfort Associated with Band Activities.

(1) Table 7 displays the result of the univariate logistic regression with foot pain/discomfort within the last year limiting daily physical activity as the dependent variable. Greater risk of foot pain/discomfort was associated with functional group (Ceremonial compared with Chorus), other physical activities (5 to 7 times per week compared with less than 1 time per week), and standing or marching for more than 2 hours (relative to less than 1 hour), rating shoe

characteristics as poor or acceptable compared with good, reporting hot feet in warm weather, reporting cold feet in cold weather, wearing orthotics and band members who replaced their shoes more frequently.

Table 7. Univariate Logistic Regression: Risk Factors for Foot Pain/Discomfort Associated with Band Activities

Variable	Level of Variable	n[1]	Reported Foot Problems (%)	Odds Ratio (95%CI)	p-value
Gender	Men	86	36	1.00	
	Women	16	43	1.38 (0.47–4.07)	0.56
Age	25–35	34	44	1.00	
	36–44	33	24	0.41 (0.14–1.15)	0.09
	45+	35	43	0.95 (0.37–0.25)	0.92
Body Mass Index	17–23	22	32	1.00	
	24–25	29	45	1.74 (0.55–5.54)	0.35
	26–27	24	33	1.07 (0.31–3.68)	0.91
	28+	27	37	1.26 (0.38–4.14)	0.70
Education Level	High School	9	33	1.00	
	Bachelors Degree	33	30	0.87 (0.18–4.19)	0.86
	Masters Degree	47	38	1.24 (0.28–5.59)	0.78
	Doctorate	4	50	2.00 (0.18–22.06)	0.57
	Unknown	9	56	2.00 (0.37–16.89)	0.35
Functional Group	Chorus	20	15	1.00	
	Ceremonial	36	72	14.73 (3.53–61.43)	<0.01
	Concert	39	23	1.70 (0.40–7.15)	0.47
	Blues	7	0	- -	- -
Standing Time	≤ 60 minutes	26	19	1.00	
	61–120 minutes	32	22	1.18 (0.33–4.26)	0.81
	121+ minutes	43	58	5.83 (1.85–18.39)	<0.01
Marching Time	≤ 60 minutes	34	24	1.00	
	61–120 minutes	25	52	3.52 (1.15–10.74)	0.03
	121+ minutes	23	65	6.09 (1.90–19.60)	<0.01
Push-Ups	12–37	33	30	1.00	
	38–45	28	32	1.09 (0.37–3.23)	0.88
	46+	33	46	1.92 (0.70–5.26)	0.21
Sit-Ups	28–44	29	41	1.00	
	45–50	29	31	0.64 (0.22–1.88)	0.41
	51+	38	40	0.92 (0.35–2.47)	0.88
2-Mile Run	12.95–16.05	23	35	1.00	
	16.06–17.38	22	27	0.70 (0.20–2.51)	0.59
	17.39+	22	27	0.70 (0.20–2.51)	0.59
Aerobic Exercise	≤ 1 time/wk	6	50	1.00	
	2–4 times/wk	66	33	0.50 (0.09–2.68)	0.42
	5–7 times/wk	29	41	0.71 (0.12–4.11)	0.70
Strength Training	≤ 1 time/wk	21	29	1.00	
	2–4 times/wk	40	37	1.48 (0.51–4.28)	0.47
	5–7 times/wk	10	50	2.50 (0.53–11.89)	0.25

Table 7. Univariate Logistic Regression: Risk Factors for Foot Pain/Discomfort Associated with Band Activities (continued)

Variable	Level of Variable	n[1]	Reported Foot Problems (%)	Odds Ratio (95%CI)	p-value
Sports Activities	≤ 1 time/wk	64	31	1.00	
	2–4 times/wk	24	50	2.20 (0.84–5.74)	0.11
	5–7 times/wk	12	42	1.57 (0.44–5.56)	0.48
Other Physical Activities	≤ 1 time/wk	26	27	1.00	
	2–4 times/wk	57	33	1.36 (0.49–3.79)	0.56
	5–7 times/wk	18	61	4.27 (1.18–15.40)	0.03
Shoe Heel Fit	Good	45	20	1.00	
	Acceptable	30	40	2.67 (0.95–7.49)	0.06
	Poor	25	68	8.50 (2.79–25.88)	<0.01
Shoe Width	Good	43	23	1.00	
	Acceptable	31	42	2.38 (0.87–6.51)	0.09
	Poor	27	56	4.13 (1.46–11.64)	<0.01
Shoe Toe Room	Good	41	17	1.00	
	Acceptable	34	41	3.40 (1.18–9.84)	0.02
	Poor	26	65	9.18 (2.92–28.88)	<0.01
Shoe Cushioning	Good	33	18	1.00	
	Acceptable	35	31	2.06 (0.66–6.43)	0.21
	Poor	33	64	7.88 (2.53–24.47)	<0.01
Shoe Flexibility	Good	37	16	1.00	
	Acceptable	32	41	3.54 (1.15–10.87)	0.03
	Poor	32	59	7.55 (2.46–23.22)	<0.01
Shoe Support	Good	28	14	1.00	
	Acceptable	40	38	3.60 (1.05–12.40)	0.04
	Poor	33	58	8.14 (2.30–28.81)	<0.01
Shoe Comfort	Good	28	14	1.00	
	Acceptable	31	36	3.30 (0.91–11.98)	0.07
	Poor	41	56	7.67 (2.25–26.10)	<0.01
Shoe Breathability	Good	29	17	1.00	
	Acceptable	32	31	2.18 (0.64–7.39)	0.21
	Poor	40	58	6.50 (2.06–20.50)	<0.01
Shoe Durability	Good	40	20	1.00	
	Acceptable	36	33	2.00 (0.71–5.66)	0.19
	Poor	25	72	10.29 (3.20–33.05)	<0.01
Shoe Style	Good	46	22	1.00	
	Acceptable	33	49	3.39 (1.27–9.01)	0.01
	Poor	19	47	3.24 (1.04–10.14)	0.04
Shoe Fit Overall	Good	44	18	1.00	
	Acceptable	26	42	3.30 (1.11–9.83)	0.03
	Poor	30	60	6.75 (2.34–19.45)	<0.01
Feet to Hot in Warm Weather	No	36	19	1.00	
	Yes	66	47	3.67 (1.41-9.55)	<0.01
Feet to Cold in Cold Weather	No	50	24	1.00	
	Yes	52	50	3.17 (1.36-7.38)	<0.01

Table 7. Univariate Logistic Regression: Risk Factors for Foot Pain/Discomfort Associated with Band Activities (continued)

Variable	Level of Variable	n[1]	Reported Foot Problems (%)	Odds Ratio (95%CI)	p-value
Orthotics	No	72	22	1.00	
	Yes	30	73	9.63 (3.61-25.69)	<0.01
How Often	0–12 months	27	70	17.58 (5.05-61.15)	<0.01
Do You Replace	1–2 years	33	42	5.45 (1.71-17.42)	<0.01
Your Shoes	>2 years	42	12	1.00	

Note: [1] Not everyone completed all of the questions on the questionnaire

(2) A backward-stepping multivariate analysis with foot pain/discomfort as the dependent variable was performed with the following selected variables for inclusion in the final model: functional group, standing, marching, other physical activities, fit in heel, width, cushioning, breathability, durability, feet too hot in warm weather, feet too cold in cold weather, orthotics and how often do you replace your shoes. There were 78 (70 percent) band members who had complete data and who could be included in the multivariate analysis. Functional group was combined into two categories (Blues, Chorus, and Concert as one group and Ceremonial as the other group) because the Blues group had no reported foot pain and only one member of the Chorus had provided complete data and could be included in the multivariate analysis. Toe room, flexibility, support, comfort, and overall fit were not selected for the model because they were highly collinear (as determined by the collinearity diagnostics test in SPSS). Style was not selected because it is not associated with physical pain. Table 8 shows the results of this analysis. Higher risk of foot pain/discomfort was independently associated with functional group (Ceremonial compared with the Blues, Chorus, and Concert group), those who reported the cushioning of the shoe as being poor or acceptable (relative to those who reported the cushioning as being good), wearing orthotics and band members who replaced their shoes more frequently.

Table 8. Multivariate Logistic Regression: Risk Factors for Foot Pain/Discomfort Associated with Band Activities

Variable	Level of Variable	n	Odds Ratio (95%CI)	p-value
Functional Group	Blues, Chorus, Concert	44	1.00	
	Ceremonial	34	8.59 (1.23-60.18)	0.03
Shoe Cushioning	Good	20	1.00	
	Acceptable	28	25.62 (2.22-295.97)	<0.01
	Poor	30	11.75 (1.54-89.66)	0.02
Orthotics	No	51	1.00	
	Yes	27	18.51 (2.85-120.28)	<0.01
How Often	0–12 months	24	11.51 (1.39-95.36)	0.02
Do You Replace	1–2 years	24	13.42 (1.91-94.32)	
Your Shoes	>2 years	30	1.00	<0.01

e. Risk Factors for Pain/Discomfort in the Knee Associated with Band Activities.

(1) Table 9 displays the result of the univariate logistic regression with knee pain/discomfort as the dependent variable. Knee pain/discomfort was associated with marching for more than 2 hours and reporting the characteristics of the shoe as poor compared with good for fit in heel, width, and toe room.

Table 9. Univariate Logistic Regression: Risk Factors for Pain/Discomfort in the Knee Associated with Band Activities

Variable	Level of Variable	n[1]	Reported Foot Problems (%)	Odds Ratio (95%CI)	p-value
Age	25–35	36	14	1.00	
	36–44	32	16	1.15 (0.30–4.40)	0.84
	45+	34	21	1.61 (0.46–5.66)	0.46
Body Mass Index	17–23	22	9	1.00	
	24–25	27	19	2.27 (0.40–13.05)	0.36
	26–27	26	15	1.82 (0.30–11.02	0.52
	28+	27	22	2.86 (0.52–15.85)	0.23
Education Level	High School	8	0		
	Bachelors Degree	31	16	1.00	
	Masters Degree	51	18	1.11 (0.34–3.69)	0.86
	Doctorate	4	50	5.20 (0.59–46.06)	0.14
	Unknown	8	13	0.74 (0.07–7.44)	0.80
Functional Group	Chorus	17	12	1.00	
	Ceremonial	37	27	2.78 (0.54–14.38)	0.22
	Concert	41	12	1.04 (0.18–5.98)	0.96
	Blues	7	0		
Standing Time	≤ 60 minutes	24	0		
	61–120 minutes	29	35	1.00	
	121+ minutes	48	65	1.14 (0.37–3.50)	0.82
Marching Time	≤ 60 minutes	36	11	1.00	
	61–120 minutes	24	13	1.14 (0.23–5.63)	0.87
	121+ minutes	25	32	3.77 (0.99–14.33)	0.05
Push-Ups	12–37	33	15	1.00	
	38–45	29	14	0.90 (0.22–3.71)	0.88
	46+	31	19	1.34 (0.37–4.95)	0.66
Sit-Ups	28–44	28	18	1.00	
	45–50	30	20	1.15 (0.31–4.29)	0.84
	51+	37	11	0.56 (0.14–2.30)	0.42
2-Mile Run	12.95–16.05	25	12	1.00	
	16.06–17.38	22	14	1.16 (0.21–6.43)	0.87
	17.39+	19	26	2.62 (0.54–12.72)	0.23
Aerobic Exercise	≤ 1 time/wk	9	11	1.00	
	2–4 times/wk	63	21	2.08 (0.24–18.16)	0.51
	5–7 times/wk	29	10	0.92 (0.08–10.15)	0.95

Table 9. Univariate Logistic Regression: Risk Factors for Pain/Discomfort in the Knee Associated with Band Activities (continued)

Variable	Level of Variable	n[1]	Reported Foot Problems (%)	Odds Ratio (95%CI)	p-value
Strength Training	≤ 1 time/wk	25	12	1.00	
	2–4 times/wk	67	19	1.77 (0.46–6.81)	0.41
	5–7 times/wk	9	11	0.92 (0.08–10.14)	0.94
Sports Activities	≤ 1 time/wk	66	15	1.00	
	2–4 times/wk	23	22	1.56 (0.47–5.15)	0.47
	5–7 times/wk	11	18	1.24 (0.23–6.63)	0.80
Other Physical Activities	≤ 1 time/wk	26	15	1.00	
	2–4 times/wk	56	13	0.79 (0.21–2.96)	0.72
	5–7 times/wk	19	32	2.54 (0.60–10.70)	0.21
Shoe Heel Fit	Good	45	11	1.00	
	Acceptable	30	13	1.23 (0.30–5.01)	0.77
	Poor	25	32	3.77 (1.08–13.18)	0.04
Shoe Width	Good	41	10	1.00	
	Acceptable	34	15	1.60 (0.39–6.48)	0.51
	Poor	26	31	4.11 (1.09–15.48)	0.04
Shoe Toe Room	Good	39	10	1.00	
	Acceptable	36	14	1.41 (0.35–5.73)	0.63
	Poor	26	31	3.89 (1.03–14.68)	0.05
Shoe Cushioning	Good	31	10	1.00	
	Acceptable	35	14	1.56 (0.34–7.12)	0.57
	Poor	35	26	3.23 (0.79–13.25)	0.10
Shoe Flexibility	Good	34	12	1.00	
	Acceptable	33	12	1.03 (0.24–4.53)	0.96
	Poor	34	27	2.70 (0.74–9.83)	0.13
Shoe Support	Good	26	8	1.00	
	Acceptable	39	18	2.63 (0.50–13.78)	0.25
	Poor	26	22	3.43 (0.66–17.72)	0.14
Shoe Comfort	Good	27	11	1.00	
	Acceptable	29	17	1.67 (0.36–7.77)	0.52
	Poor	44	18	1.78 (0.43–7.38)	0.43
Shoe Breathability	Good	28	7	1.00	
	Acceptable	29	17	2.71 (0.48–15.29)	0.26
	Poor	43	23	3.94 (0.79–19.57)	0.09
Shoe Durability	Good	40	10	1.00	
	Acceptable	34	18	1.93 (0.5–7.50)	0.34
	Poor	27	26	3.15 (0.82–12.09)	0.09
Shoe Style	Good	44	16	1.00	
	Acceptable	34	18	1.13 (0.34–3.75)	0.84
	Poor	20	20	1.32 (0.34–5.16)	0.69
Shoe Fit Overall	Good	43	12	1.00	
	Acceptable	27	19	1.73 (0.45–6.64)	0.43
	Poor	30	23	2.31 (0.66–8.15)	0.19

Table 9. Univariate Logistic Regression: Risk Factors for Pain/Discomfort in the Knee Associated with Band Activities (continued)

Variable	Level of Variable	n[1]	Reported Foot Problems (%)	Odds Ratio (95%CI)	p-value
Feet too Hot in Warm Weather	No	39	10	1.00	
	Yes	63	21	2.28 (0.69-7.56)	0.18
Feet too Cold in Cold Weather	No	47	11	1.00	
	Yes	55	22	2.34 (0.76-7.23)	0.14
Orthotics	No	71	17	1.00	
	Yes	31	16	0.95 (0.30-2.96)	0.92
How Often Do You Replace Your Shoes	0–12 months	25	28	2.96 (0.82-10.60)	0.10
	1–2 years	34	15	1.31 (0.35-4.96)	0.69
	>2 years	43	12	1.00	

Note: [1] Not everyone completed all of the questions on the questionnaire

(2) A backward-stepping multivariate analysis with knee pain/discomfort as the dependent variable was performed with the following selected variables for inclusion in the final model: marching time, fit in heel, shoe width, and toe room. The 83 (74 percent) band members, who had complete data, were included in the multivariate analysis. Table 10 shows the results of this analysis. Higher risk of knee pain/discomfort was independently associated with those who reported the fit of the heel as being poor (relative to those who reported the fit of the heel as being good).

Table 10. Multivariate Logistic Regression: Risk Factors for Pain/Discomfort in the Knee Associated with Band Activities

Variable	Level of Variable	n	Odds Ratio (95%CI)	p-value
Shoe Heel Fit	Good	32	1.00	
	Acceptable	27	1.68 (0.34–8.28)	0.52
	Poor	24	4.83 (1.12–20.82)	0.03

f. Risk Factors for Pain/Discomfort of the Back Associated with Band Activities.

(1) Table 11 displays the result of the univariate logistic regression showing the association between pain/discomfort in the back and demographics, physical activity, and shoe characteristics. Back pain/discomfort was associated with functional group (Ceremonial compared with Chorus), other physical activities (5–7 times a week compared with less than once a week), marching more than 2 hours, rating shoe characteristics as poor or acceptable compared with good, reporting hot feet in warm weather, reporting cold feet in cold weather, wearing orthotics, and band members who replaced their shoes more frequently.

Table 11. Univariate Logistic Regression: Risk Factors for Back Pain/Discomfort Associated with Band Activities

Variable	Level of Variable	n[1]	Reported Foot Problems (%)	Odds Ratio (95%CI)	p-value
Age	25–35	37	35	1.00	
	36–44	35	17	0.38 (0.13–1.16)	0.09
	45+	33	42	1.36 (0.52–3.57)	0.53
Body Mass Index	17–23	22	36	1.00	
	24–25	29	38	1.07 (0.34–3.37)	0.91
	26–27	25	32	0.82 (0.25–2.76)	0.75
	28+	29	21	0.46 (0.13–1.59)	0.22
Education Level	High School	9	33	1.00	
	BA	34	27	0.72 (0.15–3.50)	0.68
	MA	49	33	0.97 (0.21–4.39)	0.97
	PHD	4	25	0.67 (0.05–9.47)	0.77
	Unknown	9	44	1.60 (0.25–10.81)	0.63
Functional Group	Chorus	19	16	1.00	
	Ceremonial	37	54	6.28 (1.56–25.25)	0.01
	Concert	40	25	1.78 (0.43–7.40)	0.43
	Blues	9	0		
Standing Time	≤ 60 minutes	25	20	1.00	
	61–120 minutes	31	23	1.17 (0.32–4.25)	0.82
	121+ minutes	48	42	2.86 (0.92–8.90)	0.07
Marching Time	≤ 60 minutes	37	22	1.00	
	61–120 minutes	25	40	2.42 (0.79–7.40)	0.12
	121+ minutes	24	50	3.63 (1.18–11.10)	0.02
Push-Ups	12–37	34	35	1.00	
	38–45	30	27	0.67 (0.23–1.95)	0.46
	46+	33	30	0.80 (0.29–2.22)	0.66
Sit-Ups	28–44	28	36	1.00	
	45–50	30	27	0.66 (0.21–2.00)	0.46
	51+	40	33	0.87 (0.31–2.40)	0.78
2-Mile Run	12.95–16.05	24	25	1.00	
	16.06–17.38	24	33	1.50 (0.43–5.26)	0.53
	17.39+	21	24	0.94 (0.24–3.67)	0.93
Aerobic Exercise	≤ 1 time/wk	9	33	1.00	
	2–4 times/wk	67	33	0.98 (0.22–4.28)	0.98
	5–7 times/wk	29	28	0.76 (0.15–3.80)	0.74
Strength Training	≤ 1 time/wk	25	40	1.00	
	2–4 times/wk	71	27	0.55 (0.21–1.43)	0.22
	5–7 times/wk	9	44	1.20 (0.26–5.59)	0.82
Sports Activities	≤ 1 time/wk	68	32	1.00	
	2–4 times/wk	24	29	0.86 (0.31–2.38)	0.77
	5–7 times/wk	12	25	0.70 (0.17–2.83)	0.61

Table 11. Univariate Logistic Regression: Risk Factors for Back Pain/Discomfort Associated with Band Activities. (continued)

Variable	Level of Variable	n[1]	Reported Foot Problems (%)	Odds Ratio (95%CI)	p-value
Other Physical Activities	≤ 1 time/wk	28	21	1.00	
	2–4 times/wk	58	29	1.52 (0.52–4.41)	0.44
	5–7 times/wk	19	53	4.07 (1.14–14.58)	0.03
Shoe Heel Fit	Good	46	17	1.00	
	Acceptable	31	32	2.26 (0.78–6.61)	0.14
	Poor	26	58	6.48 (2.18–19.25)	<0.01
Shoe Width	Good	43	14	1.00	
	Acceptable	34	32	2.95 (0.96–9.06)	0.06
	Poor	27	59	8.97 (2.83–28.46)	<0.01
Shoe Toe Room	Good	41	10	1.00	
	Acceptable	36	33	4.63 (1.34–16.03)	0.02
	Poor	27	63	15.73 (4.31–57.35)	<0.01
Shoe Cushioning	Good	32	6	1.00	
	Acceptable	37	32	7.20 (1.47–35.25)	0.02
	Poor	35	54	17.81 (3.68–86.33)	<0.01
Shoe Flexibility	Good	35	11	1.00	
	Acceptable	35	23	2.30 (0.62–8.48)	0.21
	Poor	34	62	12.52 (3.59–43.70)	<0.01
Shoe Support	Good	26	8	1.00	
	Acceptable	43	26	4.13 (0.84–20.37)	0.08
	Poor	35	57	16.00 (3.26–78.48)	<0.01
Shoe Comfort	Good	27	7	1.00	
	Acceptable	33	27	4.69 (0.92–23.96)	0.06
	Poor	43	49	11.93 (2.51–56.75)	<0.01
Shoe Breathability	Good	28	4	1.00	
	Acceptable	32	22	7.56 (0.87–65.87)	0.07
	Poor	44	57	35.53 (4.42–285.27)	<0.01
Shoe Durability	Good	39	10	1.00	
	Acceptable	38	32	4.04 (1.17–13.96)	0.03
	Poor	27	63	14.88 (4.07–54.38)	<0.01
Shoe Style	Good	46	24	1.00	
	Acceptable	35	26	1.10 (0.40–3.04)	0.85
	Poor	20	55	3.89 (1.28–11.82)	0.02
Shoe Fit Overall	Good	45	13	1.00	
	Acceptable	28	32	3.08 (0.96–9.92)	0.06
	Poor	30	60	9.75 (3.16–30.12)	<0.01
Feet to Hot in Warm Weather	No	38	5	1.00	
	Yes	67	46	15.50 (3.45-69.65)	<0.01
Feet to Cold in Cold Weather	No	49	18	1.00	
	Yes	56	43	3.33 (1.36-8.17)	<0.01
Orthotics	No	73	21	1.00	
	Yes	32	56	4.97 (2.02-12.23)	<0.01

Table 11. Univariate Logistic Regression: Risk Factors for Back Pain/Discomfort Associated with Band Activities. (continued)

Variable	Level of Variable	n[1]	Reported Foot Problems (%)	Odds Ratio (95%CI)	p-value
How Often	0–12 months	27	48	4.91 (1.63-14.83)	<0.01
Do You Replace	1–2 years	34	38	3.27 (1.13-9.48)	0.03
Your Shoes	>2 years	44	16	1.00	

Note: [1] Not everyone completed all of the questions on the questionnaire

(2) A backward-stepping multivariate analysis with knee pain/discomfort as the dependent variable was performed with the following selected variables for inclusion in the final model: marching, functional unit, other physical activities, fit in heel, width, cushioning, durability, feet too hot is warm weather, feet too cold in cold weather, orthotics, and how often do you replace your shoes. Toe room, flexibility, support, comfort, breathability, and overall fit were not selected for the model due to high collinearity. Style was not selected because it is not associated with physical pain. Functional group was combined into two categories (Blues, Chorus, and Concert as one unit and Ceremonial as the other unit) because the Blues unit had no reported foot pain, and only one member of the chorus had complete data and could be included in the multivariate analysis. There were 84 (75 percent) band members who had complete data and who could be included in the multivariate analysis. Table 12 shows the results of this analysis. Higher risk of back pain/discomfort was independently associated with marching from 61–121 minutes (compared to marching ≤ 60 minutes), performing other physical activities 5–7 times a week (compared to ≤ 1 time a week), those who reported the cushioning of the shoe as being poor or acceptable (relative to those who reported the cushioning as being good) and reported hot feet in warm weather.

Table 12. Multivariate Logistic Regression: Risk Factors for Pain/Discomfort of the Back Associated with Band Activities

Variable	Level of Variable	n	Odds Ratio (95%CI)	p-value
Marching	≤ 60 minutes	37	1.00	
	61–120 minutes	23	6.76 (1.35-33.86)	0.02
	121+ minutes	24	2.41 (0.51-11.31)	0.27
Other Physical Activities	≤ 1 time/wk	20	1.00	
	2–4 times/wk	49	1.89 (0.39-9.22)	0.43
	5–7 times/wk	15	11.17 (1.29-96.57)	0.03
Shoe Cushioning	Good	22	1.00	
	Acceptable	30	8.26 (1.13-60.48)	0.04
	Poor	32	17.33 (2.38-126.28)	<0.01
Feet too Hot in Warm Weather	No	27	1.00	
	Yes	57	17.59 (3.04-101.81)	<0.01

g. Rating of the Bates Durashocks.

(1) On the questionnaire (Appendices B and C), band members were asked to rate the various characteristics of the Bates Durashocks on a scale of 1 to 10 (1 = low rating, 10 = high rating) after wearing them for one year. As mentioned earlier, the rating scale was collapsed into three categories for analysis. About two fifths (39–45 percent) of the band members rated the fit of the Bates Durashocks as good, one third (27–34 percent) rated comfort characteristics as good, and about two fifths (38–43 percent) rated durability and style as good. When comparing the various characteristics of the Bates Durashocks with their previous band shoes, about one fifth (17–21 percent) preferred the Bates Durashocks for fit characteristics, one third (28–35 percent) for comfort characteristics, and one fifth (15–19 percent) for durability and style (Table 13).

Table 13. Rating of the Bates Durashocks and Comparison with Previous Shoes

		Bates Durashocks Rating			**Bates Durashocks compared with shoes worn previously**		
Category	Variable	Level of Variable	n	%	Level of Variable	n	%
Fit	Fit in Heel	Good	50	45	Preferred Bates	22	20
		Acceptable	34	30	No Difference	56	50
		Poor	26	23	Preferred Previous Shoe	30	27
		Missing	2	2	Missing	4	4
	Width	Good	47	42	Preferred Bates	19	17
		Acceptable	37	33	No Difference	53	47
		Poor	27	24	Preferred Previous Shoe	36	32
		Missing	1	1	Missing	4	4
	Toe Room	Good	44	39	Preferred Bates	24	21
		Acceptable	40	36	No Difference	50	45
		Poor	27	24	Preferred Previous Shoe	34	30
		Missing	0	1	Missing	4	4
	Overall Fit	Good	48	43	Preferred Bates	22	20
		Acceptable	32	29	No Difference	53	47
		Poor	30	27	Preferred Previous Shoe	33	29
		Missing	2	2	Missing	4	4
Comfort	Flexibility	Good	38	34	Preferred Bates	31	28
		Acceptable	38	34	No Difference	40	36
		Poor	35	31	Preferred Previous Shoe	37	33
		Missing	1	1	Missing	4	4
	Support	Good	30	27	Preferred Bates	37	33
		Acceptable	45	40	No Difference	36	32
		Poor	36	32	Preferred Previous Shoe	35	31
		Missing	1	1	Missing	4	4
	Comfort	Good	31	28	Preferred Bates	39	35
		Acceptable	35	31	No Difference	34	30
		Poor	44	39	Preferred Previous Shoe	35	31
		Missing	2	2	Missing	4	4

Table 13. Rating of the Bates Durashocks and Comparison with Previous Shoes (continued)

		Bates Durashocks® Rating			**Bates Durashocks compared with shoes worn previously**		
Category	Variable	Level of Variable	n	%	Level of Variable	n	%
	Breathability	Good	31	28	Preferred Bates	33	29
		Acceptable	34	30	No Difference	39	35
		Poor	45	40	Preferred Previous Shoe	35	31
		Missing	2	2	Missing	5	4
	Cushioning	Good	35	31	Preferred Bates	36	32
		Acceptable	40	36	No Difference	34	30
		Poor	36	32	Preferred Previous Shoe	38	34
		Missing	1	1	Missing	4	4
Style		Good	48	43	Preferred Bates	17	15
		Acceptable	38	34	No Difference	60	54
		Poor	21	19	Preferred Previous Shoe	28	25
		Missing	5	4	Missing	7	6
Durability		Good	43	38	Preferred Bates	21	19
		Acceptable	40	36	No Difference	52	46
		Poor	28	25	Preferred Previous Shoe	34	30
		Missing	1	1	Missing	5	4
Environment	Feet too hot in warm weather	No	42	38	[a]	[a]	[a]
		Yes	70	63			
	Feet too cold in cold weather	No	53	47	[a]	[a]	[a]
		Yes	59	53			
Do you use Orthotics		No	77	69	[a]	[a]	[a]
		Yes	35	31			
How often do you replace your shoes		0–12 months	27	24	[a]	[a]	[a]
		1–2 years	38	34			
		>2 years	47	42			

Note: [a] No data collected on comparison with previous shoes

(2) Band members were provided the opportunity to provide open-ended comments on the Bates Durashocks. A total of 88 comments were provided by 68 band members; these have been compiled in 13 categories. A majority (67 percent) of the comments were negative. Not enough support and uncomfortable were the top two complaints about the Bates Durashocks (Table 14).

Table 14. Comments on the Bates Durashocks

Type of Comment	Comments on Bates Durashocks®	Number of Comments	%
Negative	No toe room	2	2
	Too narrow	4	5
	Bad fit	3	3
	Uncomfortable	17	19
	Unstable	4	5
	Not enough support	12	14
	Generally dislike the Durashocks®	8	9
	Not supportive of medical problems	1	1
	Poor durability	5	6
	Not good in wet weather	3	3
Neutral	No difference between previous shoe and Durashocks®	11	13
Positive	Acceptable/good	7	8
	Improvement compared with previous shoe	11	13
	Total	88	100

7. DISCUSSION. The major finding of the present study was that there were no differences in injury incidence before or while wearing the Bates Durashocks for any of the five injury indices. Despite this, the study did identify a number of injury risk factors. A higher risk of a lower-extremity-overuse injury was associated with self-reports of feet too cold in cold weather. There was higher risk of foot pain and discomfort among those who were in the ceremonial unit; they reported poor shoe cushioning, they wore orthotics, and they replaced their shoes more frequently. A higher risk of knee pain was associated with self-reports that the Bates had a poor fit in the heel. A higher risk of back pain and discomfort among those who marched for longer periods of time were involved in other physical activities 5–7 days a week reported poor or acceptable shoe cushioning (compared to good) and reported hot feet in warm weather. When examining ratings of the shoes, about two fifths (39–45 percent) of the band members rated the fit characteristics of the Bates Durashocks as good, one third (27–34 percent) rated its comfort characteristics as good, and about two fifths (38–43 percent) rated its durability and style characteristics as good.

a. Injury Incidence Before and While Wearing the Bates Durashocks. For all five injury indices, there were no differences in injury incidence before and while wearing the Bates Durashocks. In a footwear study examining Israeli infantry recruits, investigators found that Soldiers who wore basketball shoes during basic training had a lower incidence of overuse injuries of the foot compared with those who wore infantry boots (34 percent vs18 percent). However, overall overuse injury incidence of both groups was the same. Investigators concluded that in spite of the basketball shoes' superior shock attenuation, their effects on overuse injuries were limited to those of the foot[3]. In the current study, we also hypothesized that changing the current footwear may reduce injuries. However, the presumed increase in shock attenuation and

cushioning properties of the Bates Durashocks had no effect on injury incidence, and those who rated the cushioning as poor had an increased risk of foot and back pain/discomfort.

b. Risk Factors for the Lower Extremity Overuse Injuries. Complaints of cold feet during cold weather were associated with a higher risk of a lower-extremity-overuse injury. Approximately, 24 percent of these injuries were in the foot and ankle. However, when examining injury incidence for those who reported cold feet in cold weather and had an ankle or foot injury and those who reported no cold feet in cold weather and had an ankle or foot injury, there was no statistical difference (12 percent vs 6 percent, respectively, p=0.25).

c. Pain/Discomfort of the Feet, Knee and Back.

(1) A higher risk of foot pain was associated with assignment in the ceremonial unit when compared with assignment in other units. In a previous report on injuries in the U.S. Army Band[5], investigators showed that the ceremonial unit performed on average 748±116 missions per year from 1992–2005. In that study, 82% of the ceremonial unit reported shoe problems compared with 29 percent for the Blues unit, 50 percent for the Concert unit, and 54 percent for the Chorus unit. In the current study, poor overall fit of the Bates Durashocks was reported by 47 percent of the Ceremonial unit, 0 percent of the Blues unit, 27 percent of the Concert unit, and 5 percent of the chorus. In both studies, the ceremonial unit reported the largest amount of problems with their shoes. This may be related to the amount of time the ceremonial group members spent standing and marching at performances, rehearsals, and practices compared with the other units, as suggested by Table 15 (data from current study).

Table 15. Time Spent Standing and Marching during Rehearsals, Practices, and Performances by Functional Unit

Variable	Level of Variable	Chorus (%)	Ceremonial (%)	Concert (%)	Blues (%)
Standing	≤ 60 minutes	24	5	39	33
	60–120 minutes	52	14	34	22
	121+ minutes	24	81	27	44
Marching	≤ 60 minutes	100	11	61	89
	60–120 minutes	0	40	28	0
	121+ minutes	0	50	12	11

(2) In a study of supermarket workers, the amount of time standing was found to be associated with lower body discomfort and pain. Investigators found a positive correlation between the proportion of time spent standing and symptoms in the lower limb ($R^2 = 0.87$, $p<0.01$) and ankle and foot ($R^2 = 0.95$, $p<0.01$)[10]. The ceremonial unit has a rigorous schedule and spends more time standing and marching than the other units (Table 15), which was associated with a higher risk of foot pain when standing and marching (Table 16). Because the ceremonial group performs more standing and marching compared with the other units, this may contribute to their higher risk of foot pain.

Table 16. Foot and Back Pain Associated with Standing and Marching Time for each Unit

		Standing			Marching		
		Foot Pain			Foot Pain		
Time	Unit	n	%	p-value	n	%	p-value
≤ 60 minutes	Chorus	5	20	0.67	1	100	0.08
	Ceremonial	2	0		4	50	
	Concert	16	25		23	22	
	Blues	3	0		6	0	
61–121 minutes	Chorus	10	10	0.13	0	0	0.03
	Ceremonial	5	60		14	71	
	Concert	15	20		11	27	
	Blues	2	0		0	0	
121+ minutes	Chorus	5	20	<0.01	0	0	0.05
	Ceremonial	28	79		18	78	
	Concert	8	25		4	25	
	Blues	2	0		1	0	

(3) The poor cushioning rating of the shoe was associated with pain and discomfort of the feet. Band members who reported standing or marching for more than 2 hours during performances, 44 percent and 56 percent, respectively, reported the Bates Durashocks as having poor cushioning. There are no studies, to our knowledge, comparing the cushioning of dress and casual shoes. However, multiple studies have investigated musculoskeletal pain and fatigue for hard and soft surfaces, shoe softness, and shoe insoles[9, 17, 15, 23]. It has been shown that standing on a soft surface compared with a hard surface increases comfort[9, 25]. Wearing insoles, standing on a mat, or combining the two was more comfortable than standing on a hard floor[17]. Wearing insoles in occupations that required standing at least 75 percent of the time decreased foot, back, and leg pain[11]. Although these studies showed increased comfort from standing on a soft surface or wearing insoles, other studies showed either no difference in discomfort or differences only after extended standing. In one study, investigators demonstrated that 2 hours of standing in either soft shoes or clogs or standing on either a soft mat or concrete had no effect on discomfort ratings[26]. Another study showed that discomfort/fatigue ratings did not differ until the third hour of standing on a hard floor compared with floor mats of various thickness and stiffness[8]. The presumed increased cushioning of the Bates Durashocks was probably not enough to minimize discomfort and pain associated with band activities.

(4) Orthotics are functional devices designed to correct and optimize foot function. They perform functions which make standing, walking, and running more efficient and comfortable by slightly altering the angles at which the foot strikes the ground when walking or running[27]. About a third (35 of 112) of the band members reported wearing orthotics with approximately three fourths reporting foot pain attributed to band activities. About half of the Ceremonial unit wore orthotics with about three fourths of the members reporting foot pain. This could be a partial cause for the high risk of foot pain since band members in the Ceremonial unit had an

approximate 9 times higher risk of foot pain compared to the other units. Another potential reason for higher foot pain with those wearing orthotics could be the width of the shoe (which is important to comfortably accommodate the orthotics). About 91 percent of those wearing orthotics and rating the width of the shoe as poor also reported foot pain attributed to band activities.

(5) About two thirds of the band members reported wearing their band shoes for 2 years or less before replacing them. These band members were also found to be at a higher risk of foot pain when compared to those members who replaced their shoes > 2 years. About 95 percent of the Ceremonial unit replaced their shoes in less than 2 years, whereas 100 percent of the Blues, 59 percent of the Concert, and 48 percent of the Chorus replaced their shoes >2 years. The higher risk of foot pain for those who changed their shoes more often could be attributed to the Ceremonial unit who had a higher risk of foot pain and changed their shoes more frequently. In a running shoe study, they have shown that the shoes' ability to retain the initial shock and cushioning decreases with mileage. They found that between 250 to 500 miles running shoes retained less than 60 percent of their initial shock absorption capacity[28]. In resemblance to the running shoe study, the Ceremonial unit spends the most time standing and marching (Table 15); therefore, the cushioning and support in their shoes would most likely deteriorate at a faster rate than those in the other units. Another possible explanation is that band members with foot pain or injuries may change their shoes more often as a potential solution to foot pain and discomfort.

(6) A reported poor fit in the heel was associated with pain and discomfort of the knees. A poor fit of the heel could be associated with: (1) the heel sliding out of the shoe during heel-off as a result of the heel being positioned too high in relation to the topline or collar of the shoe, or (2) a lack of flexibility in the shoe[29]. The Bates Durashocks may lack flexibility as a result of the Goodyear welt construction (sewn), which is much less flexible than a cement (adhesive) construction[30]. When obtaining the proper fit of a shoe there should be a snug fit around the heel[31]. In certain shoes, the counter (the rounded back area of the shoe supporting the heel) is extended on the medial side of the shoe to resist the tendency of the foot to pronate[29]. Without adequate heel counter control (due to a poor fit or broken down counter), rearfoot kinematics may be altered, leading to knee pain and discomfort.

(7) Marching times greater than 1 hour were associated with pain and discomfort of the back. In a study investigating the prevalence of back pain among workers with repeated activities, investigators found that the number of hours spent in repeated activities at work was associated with the prevalence of back pain[32]. Overall, 90 percent of the ceremonial unit and 34 percent of the other units reported marching for greater than one hour on average when they rehearsed, practiced, or performed within the last year. Possibly reducing or keeping marching times during rehearsals and practices to 1 hour or less could reduce the prevalence of back pain and discomfort.

(8) Band members participating in other physical activities 5–7 times per week had a higher risk of back pain. However, there was no difference in back pain between the amounts of time spent participating in aerobic exercise, strength training, and sports activities. Therefore, no conclusions can be drawn as to why other physical activities placed band members at a higher risk of back pain without knowing the specific activities involved.

(10) A reported poor cushioning rating of the shoe was associated with pain and discomfort of the back. Even though the Bates Durashocks had a presumed increase in cushioning, it was not sufficient for the 38 percent of band members who reported poor cushioning of the shoe and back pain attributed to band activities. To increase the amount of cushioning in the shoe and decrease back pain, the Army band may consider using insoles. Insoles have been shown to increase shock attenuation[15], reduce heel strike shock waves[14], decrease back pain[11, 16, 18, 19], and lower the incidence of overuse injuries[20].

(11) Experiencing feet too hot in warm weather was associated with a higher risk of back pain and discomfort. When examining the amount of time standing and marching for over 2 hours, 90 percent and 100 percent of those who reported back pain and discomfort also reported hot feet in warm weather, respectively. Therefore, band members who were exposed to a hot environment for longer periods of time would be more likely to report hot feet in warm weather as well as reporting back pain and discomfort.

d. Rating of the Bates Durashocks.

(1) Overall, about a third (31–40 percent) of the band members rated the comfort and about a quarter (23–27 percent) rated the fit characteristics of the Bates Durashocks as poor. This, however, could be perceived as an improvement over the previous study of the U.S. Army Band, where 53 percent of the band members noted problems with their current footwear[5]. Shoes worn by band members before the Bates Durashocks included Bates Lites® (35 percent), Thorogoods® (6 percent), Bates with no model indicated (31 percent), and a standard Army-issue, low-quarter shoe (3 percent). (A quarter of the band members did not answer this question). In a study with nursing students, (who, like the band members, are required to stand and walk for long periods of time), investigators examined three types of shoes for comfort and identified shoe features important for adequate support. They found that arch support could decrease muscle fatigue in the calf and disperse arch pressure; shoes with outsoles of 1.5 centimeters (cm) thickness in the metatarsal zone tended to produce lower metatarsal pressure; shoes with a soft leather upper and midsole made of EVA or polyurethane (PU) materials helped increase foot comfort; and a heel height of 1.8–3.6 cm reduced ankle discomfort[4]. The Bates Durashocks have a rubber midsole for men (the women's shoes have no midsole); the upper is a man-made, high-gloss synthetic material; there is minimal arch support, and the heel is approximately 1.3 cm. Therefore, the shoe meets none of the criteria for factors identified as important for comfort and adequate shoe support for long-term standing in the nursing student

shoe study. (Bates Lites® is a registered trademark of Wolverine World Wide, Inc; Thorogood® is a registered trademark of the Weinbrenner Shoe Company.)

(2) In the current study, it is possible that the band members who rated various characteristics of the Bates Durashocks as poor may not have selected a shoe of appropriate length and width. A study involving infantry recruits found that recruits compensated for lack of available shoe widths by choosing larger shoes and that three width sizes are necessary for each shoe size to ensure a proper fit[3]. In the current study, 24 percent of the band members reported the width of the Bates Durashocks as poor. It is possible that those who might have selected a larger shoe due to wide feet would then experience a poor fit in the heel. In the comments section of the questionnaire, one female band member stated that it is impossible to find shoes for women in wide widths and that most women in the Band wear men's shoes. This may be the cause of a poor fitting shoe due to the gender differences in adult foot shape. At comparable foot lengths, a woman's foot has a higher arch, shallower first toe, a shorter ankle length, a shorter length of the outside ball of the foot, and a smaller instep circumference than a man[33]. The shoe last in the Bates shoes is also cut one width narrower than men's shoe last and is 1.5 to 2 sizes smaller in length (personal communication, with Bates Consumer Relations). On the other hand, another study reported that 88 percent of 356 women surveyed (73 percent were patients from an orthopedic office, and 27 percent were not patients) were wearing shoes smaller than their feet, with 80 percent of these women reporting foot pain while wearing these shoes[34]. Band members can ensure a proper fit of their shoes (thereby, potentially increasing the comfort of their shoes) by making certain the shoe accommodates the first metatarsophalangeal joint in the widest part of the shoe and that it has ⅜ to ½ inch of toe room between the longest toe and the end of the shoe, proper width allowing adequate room across the ball of the foot, and a snug fit around the heel[31].

(3) With regard to environmental conditions, a majority of the band members found the shoes to be too hot in warm weather and too cold in cold weather. In Washington, DC, where the band performs, the average low temperature is around 30 ºFahrenheit (F) in the winter and the average high is around 85 ºF in the summer[35]. Wearing the same shoe for both winter and summer may make it difficult to control for environmental conditions.

(4) Exposure to the cold causes a decrease in peripheral circulation in order to preserve thermal homeostasis of the body core. This protective response causes a drop in skin temperature and a cooling of the extremities because heat is lost faster than it is replaced. The feet are more susceptible to losing heat during the cold due to the low mass-to-area ratio of the foot and the lack of foot muscles for heat production during work. As a consequence, the feet are dependent on the circulation of heat from other parts of the body. It has been demonstrated that the average-resting blood flow to the feet decreases when the feet are cooled[36, 37]. In cold conditions, exercise has been shown to increase circulation and rewarm the feet[38]. However, during low activity (such as sitting, standing, and walking), the foot skin temperatures drop

quickly, even in well insulted boots[39]. Band members who reported cold feet could wear an extra thick pair of socks, which has been shown to increase the amount of insulation[40], thereby reducing heat loss. However, thick socks require more space in the shoe and may feel uncomfortable or crowd the foot.

(5) Exposure to the heat causes an increase in blood flow to the feet. Blood flow to the foot increases with temperature. This increase is gradual as the feet warm from 59 ºF to 84 ºF; once above 84 ºF to 90 ºF, blood flow to the feet rapidly increases[36]. The Bates Durashocks have eyeleted vent holes on the sides of the shoes which the manufacturer claims help keep the feet ventilated and provide air circulation inside the shoe. However, with 63 percent of the band members reporting their feet as too hot, the eyeleted vent holes apparently did not provide adequate ventilation to cool the feet under the conditions the band experienced.

8. CONCLUSIONS. No differences were found for injury rates among band members before or while wearing the Bates Durashocks. Specific shoe characteristics associated with musculoskeletal pain and discomfort was poor cushioning of the shoe associated with foot and back pain, and a poor fit in the heel associated with knee pain and discomfort. Compared with the other units, the Ceremonial unit had a higher risk of foot pain and discomfort. Shoe characteristics rated acceptable or good to some were rated poor by others. These differences could be attributed to fit and/or mechanical shoe variables such as cushioning and support.

9. RECOMMENDATION. It is not recommended that the U.S. Army Band switch shoes. To increase cushioning and comfort, the band may consider insoles, a list of appropriate band shoes for individual subjective comfort preferences, and instructions on obtaining a proper fit of the shoe.

10. POINT OF CONTACT. Mr. Tyson Grier, the principal investigator, is the point of contact for this project. He may be reached at 410-436-5450 (commercial) or 584-5450 (DSN) or by email at tyson.grier@us.army.mil.

E-Signed by Tyson L Grier
VERIFY authenticity with ApproveIt

TYSON L GRIER Health Scientist

Reviewed by:

E-Signed by Bruce H Jones
VERIFY authenticity with ApproveIt

BRUCE JONES Program Manager, Injury Prevention

APPENDIX A

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APPENDIX B

QUESTIONNAIRE FOR ARMY BAND (INSTRUMENTALISTS) [EXAMPLE]

In this questionnaire you will be asked about playing your instrument, your health, and your lifestyle. Please answer each question as accurately as possible.

Name _____

PLAYING YOUR INSTRUMENT AND PERFORMING

1. **TIME WITH YOUR INSTRUMENT.** Your primary musical instrument is the one you use for most US Army Band functions. How many years have you been playing your **primary** musical instrument?

◯ Less than 6 years	◯ 21–23 years	◯ 36–38 years
◯ 6–8 years	◯ 24–26 years	◯ 39–41years
◯ 9–11 years	◯ 27–29 years	◯ 42–44 years
◯ 12–14 years	◯ 30–32 years	◯ 45–47 years
◯ 15–17 years	◯ 33–35 years	◯ More than 47 years
◯ 18–20 years		

2. **PLAYING FREQUENCY**. How many days/wk did you rehearse, practice and/or perform with your **primary** musical instrument in the last year, **on average** (including U.S. Army Band activities and elsewhere)?

◯ None	◯ 2 days/wk	◯ 5 days/wk
◯ Less than 1 day/wk	◯ 3 days/wk	◯ 6 days/wk
◯ 1 day/wk	◯ 4 days/wk	◯ 7 days/wk

3. **PLAYING DURATION.** On days when you rehearsed, practiced and/or performed with your **primary** musical instrument in the last year, how long did you play, **on average** (including U.S. Army Band activities and elsewhere)?

◯ None	◯ 181–240 min (3–4 hours)
◯ Less than 30 min	◯ 241–300 min (4–5 hours)
◯ 30–60 min	◯ 301–360 min (5–6 hours)
◯ 61–120 min (1–2 hours)	◯ 361–420 min (6–7 hours)
◯ 121–180 min (2–3 hours)	◯ More than 420 min (more than 7 hours)

4. OTHER MUSICAL INSTRUMENT. Do you have other musical instruments you play?

- ◯ No (If no, go to Question 7)
- ◯ Yes If Yes, what are the other instruments?

Other Instruments_____

5. PLAYING FREQUENCY. How many days/wk did you rehearse, practice, and/or perform with your **other** musical instrument in the last year, **on average** (including U.S. Army Band activities and elsewhere)?

- ◯ No secondary instrument
- ◯ Less than 1 day/wk
- ◯ 1 day/wk
- ◯ 2 days/wk
- ◯ 3 days/wk
- ◯ 4 days/wk
- ◯ 5 days/wk
- ◯ 6 days/wk
- ◯ 7 days/wk

6. PLAYING DURATION. On days when you rehearsed, practiced, and/or performed with your **other** musical instruments in the last year, how long did you play, **on average** (including U.S. Army Band activities and elsewhere)?

- ◯ None
- ◯ Less than 30 min
- ◯ 30–60 min
- ◯ 61–120 min (1–2 hours)
- ◯ 121–180 min (2–3 hours)
- ◯ 181–240 min (3–4 hours)
- ◯ 241–300 min (4–5 hours)
- ◯ 301–360 min (5–6 hours)
- ◯ More than 360 min (more than 6 hours)

7. STANDING

a. How much time did you spend standing when you rehearsed, practiced, or performed, **on average within the last year**?

- ◯ None
- ◯ Less than 30 min
- ◯ 30–60 min
- ◯ 61–90 min (1–1.5 hours)
- ◯ 91–120 min (1.5–2 hours)
- ◯ 121–150 min (2–2.5 hours)
- ◯ 151–180 min (2.5–3 hours)
- ◯ 181–240 min (3–4 hours)
- ◯ More than 240 min (more than 4 hours)

b. What percent of the time did you spend standing when you rehearsed, practiced, or performed, **on average within the last year**?

- ◯ None
- ◯ 1–10%
- ◯ 11–20%
- ◯ 21–30%
- ◯ 31–40%
- ◯ 41–50%
- ◯ 51–60%
- ◯ 61–70%
- ◯ 71–80%
- ◯ 81–90%
- ◯ 91–100%

8. MARCHING

a. How much time did you spend marching when you rehearsed, practiced, or performed, **on average within the last year**?

- ◯ None
- ◯ Less than 30 min
- ◯ 30–60 min
- ◯ 61–90 min (1–1.5 hours)
- ◯ 91–120 min (1.5–2 hours)
- ◯ 121–150 min (2–2.5 hours)
- ◯ 151–180 min (2.5–3 hours)
- ◯ 181–240 min (3–4 hours)
- ◯ More than 240 min (more than 4 hours)

b. What percent of the time did you spend marching when you rehearsed, practiced, or performed, **on average within the last year**?

- ◯ None
- ◯ 1–10%
- ◯ 11–20%
- ◯ 21–30%
- ◯ 31–40%
- ◯ 41–50%
- ◯ 51–60%
- ◯ 61–70%
- ◯ 71–80%
- ◯ 81–90%
- ◯ 91–100%

9. WELLNESS INSTRUCTION

a. Wellness involves care of the body through diet, exercise, and rest. While in music school, did you receive instruction on wellness?

- ◯ No
- ◯ Yes

b. While in the Army, did you receive instruction on wellness?

- ◯ No
- ◯ Yes

10. RELAXATION WHILE PLAYING

a. Do you usually feel relaxed when you play?

- ◯ No
- ◯ Yes

b. When playing, do you deliberately work on relaxing your muscles?

- ◯ No
- ◯ Yes

11. SHOES

a. New shoes were purchased for many members of the U.S. army Band in June 2007. These shoes were Bates Durashocks. Did you receive these shoes?

- ◯ No (If no, go to Question 12)
- ◯ Yes
- ◯ Unsure

b. How many pairs of Bates Durashocks did you receive?

- ◯ One Pair
- ◯ Two Pairs
- ◯ Three or more

If you received two or more pairs of Bates Durashocks, did you periodically switch between shoes (as opposed to continually wearing one pair)? (ex. Used one pair for practice and the other pair for performances or just switched between shoes every other day)

- ◯ No
- ◯ Yes
- ◯ Not applicable

If you did not periodically switch between shoes, how many months did you wear the one pair of Bates Durashocks before replacing them with the second pair? _____Months

- ◯ I haven't worn the second pair
- ◯ Not applicable

c. What percentage of time did you wear the Bates Durashocks during

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Practices	○	○	○	○	○	○	○	○	○	○	○
Rehearsals	○	○	○	○	○	○	○	○	○	○	○
Performances	○	○	○	○	○	○	○	○	○	○	○

d. What U.S. Army band shoe were you wearing previous to the Bates Durashocks?

Brand _____

Model _____

e. What other type of shoes did you wear for practices, performances, or rehearsals?

○ No other type

Brand _____Model _____

Brand _____Model _____

Brand _____Model _____

If you wrote in another shoe above, do you prefer this shoe over the Bates Durashocks?

○ No

○ Yes

If yes, why? _____

f. Rate the Bates Durashocks on the following: (1=low rating, 10 = high rating)

	1	2	3	4	5	6	7	8	9	10
Fit in heel area	○	○	○	○	○	○	○	○	○	○
Width of shoe	○	○	○	○	○	○	○	○	○	○
Amount of toe room	○	○	○	○	○	○	○	○	○	○
Overall fit	○	○	○	○	○	○	○	○	○	○
Cushioning	○	○	○	○	○	○	○	○	○	○
Flexibility	○	○	○	○	○	○	○	○	○	○
Support	○	○	○	○	○	○	○	○	○	○
Comfort	○	○	○	○	○	○	○	○	○	○
Breathability	○	○	○	○	○	○	○	○	○	○
Durability	○	○	○	○	○	○	○	○	○	○
Style	○	○	○	○	○	○	○	○	○	○

g. Any comments from the questions above pertaining to the fit, support, durability, etc. .....

_____

_____

_____

h. How does the Bates Durashocks compare to the shoes you were wearing just before you received the Bates Durashocks?

1 = lower rating of previous shoe compared to Bates Durashocks
5 = same as Bates Durashocks,
10 = high rating of previous shoe compared to Bates Durashock

	1	2	3	4	5	6	7	8	9	10
Fit in heel area	○	○	○	○	○	○	○	○	○	○
Width of shoe	○	○	○	○	○	○	○	○	○	○
Amount of toe room	○	○	○	○	○	○	○	○	○	○
Overall fit	○	○	○	○	○	○	○	○	○	○
Cushioning	○	○	○	○	○	○	○	○	○	○
Flexibility	○	○	○	○	○	○	○	○	○	○
Support	○	○	○	○	○	○	○	○	○	○
Comfort	○	○	○	○	○	○	○	○	○	○
Breathability	○	○	○	○	○	○	○	○	○	○
Durability	○	○	○	○	○	○	○	○	○	○
Style	○	○	○	○	○	○	○	○	○	○

i. Any comments from the questions above comparing the Bates Durashocks to your previous U.S. Army Band Shoes?

_____

_____

_____

j. Do your feet become too hot in the Bates Durashocks in warm weather?

○ No

○ Yes

k. Do your feet become too cold in the Bates Durashocks in cold weather?

○ No

○ Yes

l. Do you use orthotics in your Bates Durashocks?

- ◯ No
- ◯ Yes

m. What type of socks did you usually wear with your Bates Durashocks? Describe the composition (cotton, wool, nylon, polyester, etc.), style and type of socks you usually wear. If you wear several types of socks list them in the order from the one you wear most to least:

1. Composition of sock_____ Brand/Model_____
2. Composition of sock_____ Brand/Model_____
3. Composition of sock_____ Brand/Model_____

n. On average, how often do you replace the shoes you use for practices, rehearsals, or performances?

- ◯ 1–6 months
- ◯ 1–1.5 years
- ◯ 2–3 years
- ◯ 7–12 months
- ◯ 1.6–2 years
- ◯ more than 3 years

o. After wearing the Bates Durashock shoes for one year, how often would you say it needs to be replaced?

- ◯ 1–3 months
- ◯ 7–9 months
- ◯ >1 year
- ◯ 4–6 months
- ◯ 1 year

p. Other comments on Bates Durashocks?

_____

_____

_____

12. UNIFORMS. Did you have any problems with the uniforms you wore for performances in the last year?

- ◯ No
- ◯ Yes. If Yes, what were the problems?

_____

_____

EXERCISE AND SPORTS

13. AEROBIC EXERCISE

a. How many days per week did you perform aerobic exercise (running, cycling, swimming, etc.) in the last year, on average?

◯ None	◯ 2 days/wk	◯ 5 days/wk
◯ Less than 1 day/wk	◯ 3 days/wk	◯ 6 days/wk
◯ 1 day/wk	◯ 4 days/wk	◯ 7 days/wk

b. On days when you performed aerobic exercise (running, cycling, swimming, etc.) in the last year, how long did you exercise, on average?

◯ None	◯ 15–30 min	◯ 46–60 min
◯ Less than 15 min	◯ 31–45 min	◯ More than 60 min

14. STRENGTH TRAINING

a. How many days per week did you exercise to improve your strength (free weights, universal, nautilus, push-ups, sit-ups, etc.) in the last year, on average?

◯ None	◯ 2 days/wk	◯ 5 days/wk
◯ Less than 1 day/wk	◯ 3 days/wk	◯ 6 days/wk
◯ 1 day/wk	◯ 4 days/wk	◯ 7 days/wk

b. On days when you exercised to improve your strength (free weights, universal, nautilus, push-ups, sit-ups, etc.) in the last year, how long did you exercise, on average?

◯ None	◯ 15–30 min	◯ 46–60 min
◯ Less than 15 min	◯ 31–45 min	◯ More than 60 min

15. SPORTS ACTIVITY

a. How many days per week did you participate in sports activities in the last year, on average?

◯ None	◯ 2 days/wk	◯ 5 days/wk
◯ Less than 1 day/wk	◯ 3 days/wk	◯ 6 days/wk
◯ 1 day/wk	◯ 4 days/wk	◯ 7 days/wk

b. On days that you participated in sports activities in the last year, how long did you participate, on average?

- ◯ None
- ◯ Less than 15 min
- ◯ 15–30 min
- ◯ 31–45 min
- ◯ 46–60 min
- ◯ 61–90 min (1–1.5 hours)
- ◯ 91–120 min (1.5 to 2 hours
- ◯ 121–150 min (2–2.5 hours)
- ◯ More than 150 min (more than 2.5 hours)

16. OTHER PHYSICAL ACTIVITY

a. How many days per week did you perform other physical activity (like gardening, home repair, hunting, fishing, wood cutting, etc.) in the last year, on average?

- ◯ None
- ◯ Less than 1 day/wk
- ◯ 1 day/wk
- ◯ 2 days/wk
- ◯ 3 days/wk
- ◯ 4 days/wk
- ◯ 5 days/wk
- ◯ 6 days/wk
- ◯ 7 days/wk

b. On days that you performed other physical activity (like gardening, home repair, hunting, fishing, wood cutting, etc.) in the last year, how long did you participate, on average?

- ◯ None
- ◯ Less than 15 min
- ◯ 15–30 min
- ◯ 31–45 min
- ◯ 46–60 min
- ◯ 61–120 min (1–2 hours)
- ◯ 121–180 min (2–3 hours
- ◯ 181–240 min (3–4 hours)
- ◯ 241–300 min (4–5 hours)
- ◯ More than 300 min (more than 5 hours)

17. OVERALL PHYSICAL ACTIVITY. Overall, how would you rate yourself as to the amount of physical activity you perform, compared to others of your age and sex?

- ◯ Much more active
- ◯ Somewhat more active
- ◯ About the same
- ◯ Somewhat less active
- ◯ Much less active

TOBACCO USE

18. SMOKING: Which statement best describes your smoking habits in the last year?

- ○ I have never been a smoker
- ○ I smoked but quit → ○ I quit less than 6 months ago
- ○ I smoke 10 or fewer cigarettes per day ○ I quit 6 months to 1 year ago
- ○ I smoke 11 to 20 cigarettes per day ○ I quit more than a year ago
- ○ I smoke more than 20 cigarettes per day

19. SMOKELESS TOBACCO: What statement best describes your use of smokeless tobacco (chewing, dipping or pinching) in the last year?

- ○ I have never used smokeless tobacco
- ○ I used smokeless tobacco but quit → ○ I quit less than 6 months ago
- ○ I use smokeless tobacco one time per day or less ○ I quit 6 months to 1 year ago
- ○ I use smokeless tobacco 2-4 times per day ○ I quit more than a year ago
- ○ I use smokeless tobacco 5-10 times per day
- ○ I use smokeless tobacco more than 10 times per day

MEDICAL PROBLEMS AND MEDICAL CARE

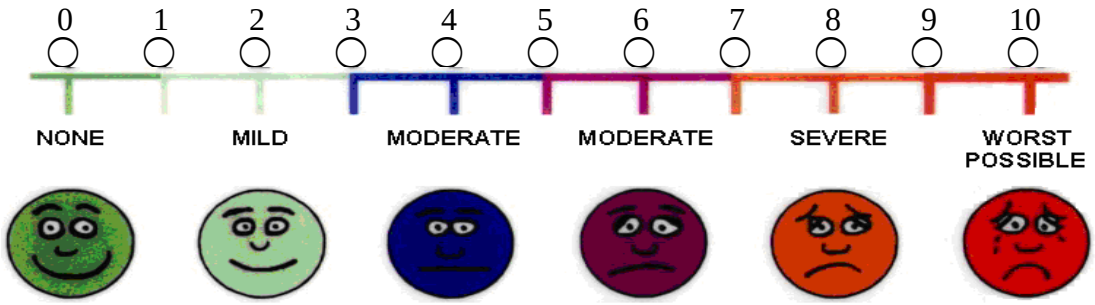
20. PAIN WHILE PLAYING. Did you have pain, soreness, discomfort, weakness, numbness, or tingling while rehearsing, practicing, and/or performing in the last year?

- ○ No (If no, go to Question 24)
- ○ Yes.

a. If yes, in what part of your body did you experience **the most** pain, soreness, discomfort, weakness, numbness, or tingling while practicing or performing?

_____

b. If yes, grade the pain, soreness, discomfort, weakness, numbness, or tingling for this part of your body (circle a number).



21. PAIN WHILE PLAYING. Is there a **second part of your body** where you had pain, soreness, discomfort, weakness, numbness, or tingling while rehearsing, practicing, or performing within the last year?

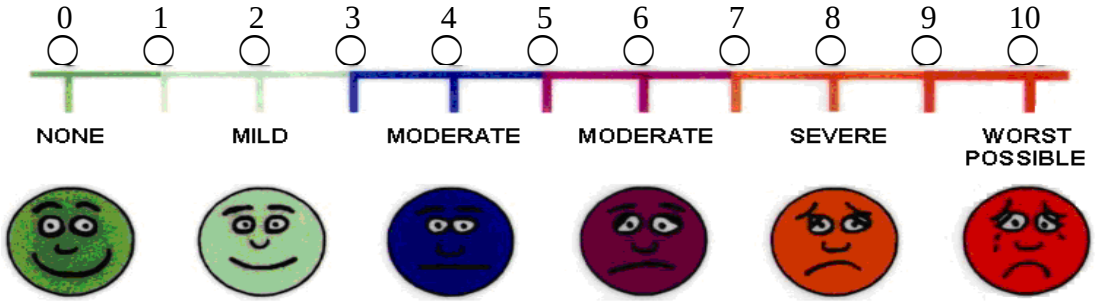
○ No (If no, go to Question 24)

○ Yes.

a. If yes, what was this second part of your body where you experienced pain, soreness, discomfort, weakness, numbness, or tingling?

_____

b. If yes, grade the pain, soreness, discomfort, weakness, numbness, or tingling for this part of your body.



22. PAIN WHILE PLAYING. Are there other parts of your body where you experienced pain, soreness, discomfort, weakness, numbness, or tingling when rehearsing, practicing, or performing within the last year?

- ○ No
- ○ Yes

23. CHANGES DUE TO PAIN. Did pain, soreness, discomfort, weakness, numbness, or tingling ever cause you to modify the way you held or played your instrument within the last year?

- ○ Unsure
- ○ No
- ○ Yes If yes, how did you modify your holding or playing of the instrument?

_____

24. FOOT PROBLEMS: Did you have foot pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ○ No
- ○ Yes If yes, was this caused by your participation in Band activities?
  - ○ No
  - ○ Yes
  - ○ Unsure

25. KNEE PROBLEMS: Did you have knee pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ○ No
- ○ Yes If yes, was this caused by your participation in Band activities?
  - ○ No
  - ○ Yes
  - ○ Unsure

26. BACK PROBLEMS: Did you have back pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ○ No
- ○ Yes If yes, was this caused by your participation in Band activities?
  - ○ No
  - ○ Yes
  - ○ Unsure

27. SHOULDER PROBLEMS: Did you have shoulder pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

28. NECK PROBLEMS: Did you have neck pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

29. WRIST PROBLEMS: Did you have wrist pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

30. HAND/FINGER PROBLEMS: Did you have hand or finger pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

31. DENTAL PROBLEMS: Did you have problems with your teeth, jaws or embouchure (lips and tongue) that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

32. VOCAL PROBLEMS: Did you have vocal pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

33. INJURIES YOU HAVE HAD. Injuries include acute injuries (those that are sudden and unexpected) as well as overuse injuries (those involving pain that develops over time and might be chronic or recurrent). Did you have one or more injuries in the last year, **related to playing your musical instrument** (whether or not you sought medical care for these injuries)?

- ◯ No (If no, go to Question 35)
- ◯ Yes

34. INJURIES: If you had an injury within the last year **related to playing your musical instrument**, complete the information below. If you had more than one injury to a particular body part, list only the most serious one.

	Injured				
Body Part	**NO**	**YES**	**Type of Injury**	**Cause of injury**	**Days of Limited Duty (profile), if any**
Vocal Cords	○	○	_____	_____	_____
Teeth/Jaws	○	○	_____	_____	_____
Head	○	○	_____	_____	_____
Neck	○	○	_____	_____	_____
Shoulders	○	○	_____	_____	_____
Upper Arm	○	○	_____	_____	_____
Lower Arm	○	○	_____	_____	_____
Wrist	○	○	_____	_____	_____
Hand	○	○	_____	_____	_____
Fingers	○	○	_____	_____	_____
Chest	○	○	_____	_____	_____
Upper Back	○	○	_____	_____	_____
Lower Back	○	○	_____	_____	_____
Abdomen	○	○	_____	_____	_____
Hip	○	○	_____	_____	_____
Thigh	○	○	_____	_____	_____
Knee	○	○	_____	_____	_____
Calf/Shin	○	○	_____	_____	_____
Ankle	○	○	_____	_____	_____
Foot	○	○	_____	_____	_____
Toes	○	○	_____	_____	_____

35. HEALTH CARE FACILITY. Where do you usually get your medical care?

- ◯ Rader Health Clinic (Ft. Myer)
- ◯ Walter Reed Army Medical Center
- ◯ DeWitt Army Community Hospital (Ft. Belvior)
- ◯ Other military medical facility. Name: _____
- ◯ Civilian medical facility. Name: _____

36. SATISFACTION WITH MEDICAL CARE. How satisfied are you with the quality of the medical care you have received at the medical facility?

- ◯ Completely satisfied
- ◯ Reasonably satisfied
- ◯ Borderline
- ◯ Moderately unsatisfied
- ◯ Extremely unsatisfied

37. CHANGES YOU WOULD RECOMMEND. To reduce the possibility of injury, what two aspects of your job would you change (if any)?

1. _____
2. _____

HEARING

38. To what degree are you concerned about hearing loss from what you do in the Army Band?

- ◯ Extremely concerned
- ◯ Very concerned
- ◯ Somewhat concerned
- ◯ A little unconcerned
- ◯ Not concerned

39. Do you take more than one aspirin a day on a fairly regular basis?
- ◯ No
- ◯ Yes

40. Do you use hearing protection during practice sessions?
- ◯ Never
- ◯ Sometimes
- ◯ Always

41. Do you use hearing protection during rehearsals?
- ◯ Never
- ◯ Sometimes
- ◯ Always

42. Do you use hearing protection during performances?
- ◯ Never
- ◯ Sometimes
- ◯ Always

43. Would you use a hearing protector that not only protected your hearing, but also enhanced your ability to hear others and monitor your performance?
- ◯ No
- ◯ Yes

ADDITIONAL COMMENTS

44. Provide any additional comments or thoughts you have.

_____

_____

_____

_____

_____

_____

APPENDIX C

QUESTIONNAIRE FOR ARMY BAND (VOCALISTS) [EXAMPLE]

In this questionnaire you will be asked about your vocal practice, your dancing, your health, and your lifestyle. Please answer each question as accurately as possible.

Name _____

VOCAL/DANCE REHEARSAL, PRACTICE, AND PERFORMANCE

1. **DANCING.** In addition to singing in the U.S. Army Band, do you also dance as part of your Band activities?
   - ◯ No
   - ◯ Yes

2. **PRACTICE FREQUENCY**. How many days/wk did you sing and/or dance in the last year, on average (include practices, rehearsals, and performances in the band and elsewhere)?
   - ◯ None
   - ◯ Less than 1 day/wk
   - ◯ 1 day/wk
   - ◯ 2 days/wk
   - ◯ 3 days/wk
   - ◯ 4 days/wk
   - ◯ 5 days/wk
   - ◯ 6 days/wk
   - ◯ 7 days/wk

3. **PRACTICE DURATION.** On days when you sang and/or danced in the last year, how long did you do this on average (include practices, rehearsals, and performances in the band and elsewhere).
   - ◯ None
   - ◯ Less than 30 min
   - ◯ 30–60 min
   - ◯ 61–120 min (1–2 hours)
   - ◯ 121–180 min (2–3 hours)
   - ◯ 181–240 min (3–4 hours)
   - ◯ 241–300 min (4–5 hours)
   - ◯ 301–360 min (5–6 hours)
   - ◯ 361–420 min (6–7 hours)
   - ◯ More than 420 min (more than 7 hours)

4. STANDING

a. How much time did you spend standing when you rehearsed, practiced, or performed, **on average within the last year**?

- ◯ None
- ◯ Less than 30 min
- ◯ 30–60 min
- ◯ 61–90 min (1–1.5 hours)
- ◯ 91–120 min (1.5–2 hours)
- ◯ 121–150 min (2–2.5 hours)
- ◯ 151–180 min (2.5–3 hours)
- ◯ 181–240 min (3–4 hours)
- ◯ More than 240 min (more than 4 hours)

b. What percent of the time did you spend standing when you rehearsed, practiced, or performed, **on average within the last year**?

- ◯ None
- ◯ 1–10%
- ◯ 11–20%
- ◯ 21–30%
- ◯ 31–40%
- ◯ 41–50%
- ◯ 51–60%
- ◯ 61–70%
- ◯ 71–80%
- ◯ 81–90%
- ◯ 91–100%

5. WELLNESS INSTRUCTION

a. Wellness involves care of the body through diet, exercise, and rest. While in music school, did you receive instruction on wellness?

- ◯ No
- ◯ Yes

b. While in the Army, did you receive instruction on wellness?

- ◯ No
- ◯ Yes

6. SHOES

a. New shoes were purchased for many members of the Band in June 2007. These shoes were Bates Durashocks. Did you receive these shoes?

- ◯ No (If no, go to Question 7)
- ◯ Yes
- ◯ Unsure

b. How many pairs of Bates Durashocks did you receive?

- ◯ One Pair
- ◯ Two Pairs
- ◯ Three or more

If you received two or more pairs of Bates Durashocks, did you periodically switch between shoes (as opposed to continually wearing one pair)? (ex. Used one pair for practice and the other pair for performances or just switched between shoes every other day)

- ◯ No
- ◯ Yes
- ◯ Not applicable

If you did not periodically switch between shoes, how many months did you wear the one pair of Bates Durashocks before replacing them with the second pair? _____Months

- ◯ I haven't worn the second pair
- ◯ Not applicable

c. What percentage of time did you wear the Bates Durashocks during:

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Practices	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Rehearsals	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Performances	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

d. What U.S. Army Band shoe were you wearing previous to the Bates Durashocks?

Brand _____

Model _____

e. What other type of shoes did you wear for practices, performances or rehearsals?

○ No other type

Brand _____Model _____

Brand _____Model _____

Brand _____Model _____

If you wrote in another shoe above, do you prefer this shoe over the Bates Durashocks?

○ No

○ Yes

If yes, why? _____

f. Rate the Bates Durashocks on the following: (1=low rating, 10 = high rating)

	1	2	3	4	5	6	7	8	9	10
Fit in heel area	○	○	○	○	○	○	○	○	○	○
Width of shoe	○	○	○	○	○	○	○	○	○	○
Amount of toe room	○	○	○	○	○	○	○	○	○	○
Overall fit	○	○	○	○	○	○	○	○	○	○
Cushioning	○	○	○	○	○	○	○	○	○	○
Flexibility	○	○	○	○	○	○	○	○	○	○
Support	○	○	○	○	○	○	○	○	○	○
Comfort	○	○	○	○	○	○	○	○	○	○
Breathability	○	○	○	○	○	○	○	○	○	○
Durability	○	○	○	○	○	○	○	○	○	○
Style	○	○	○	○	○	○	○	○	○	○

g. Any comments from the questions above pertaining to the fit, support, durability etc.....

_____

_____

_____

h. How do the Bates Durashocks compare to the shoes you were wearing just before you received the Bates Durashocks?

(1 = lower rating of previous shoe compared to Bates Durashocks,
5 = same as Bates Durashocks,
10 = high rating of previous shoe compared to Bates Durashocks)

	1	2	3	4	5	6	7	8	9	10
Fit in heel area	○	○	○	○	○	○	○	○	○	○
Width of shoe	○	○	○	○	○	○	○	○	○	○
Amount of toe room	○	○	○	○	○	○	○	○	○	○
Overall fit	○	○	○	○	○	○	○	○	○	○
Cushioning	○	○	○	○	○	○	○	○	○	○
Flexibility	○	○	○	○	○	○	○	○	○	○
Support	○	○	○	○	○	○	○	○	○	○
Comfort	○	○	○	○	○	○	○	○	○	○
Breathability	○	○	○	○	○	○	○	○	○	○
Durability	○	○	○	○	○	○	○	○	○	○
Style	○	○	○	○	○	○	○	○	○	○

i. Any comments from the questions above comparing the Bates Durashocks to your previous U.S. Army Band Shoes?

_____

_____

_____

j. Do your feet becme too hot in the Bates Durashocks in warm weather?

○ No

○ Yes

k. Do your feet become too cold in the Bates Durashocks in cold weather?

○ No

○ Yes

l. Do you use orthotics in your Bates Durashocks?

- ◯ No
- ◯ Yes

m. What type of socks did you usually wear with your Bates Durashocks? Describe the composition (cotton, wool, nylon, polyester, etc,), style and type of socks you usually wear. If you wear several types of socks list them in the order from the one you wear most to least:

1. Composition of sock_____ Brand/Model_____
2. Composition of sock_____ Brand/Model_____
3. Composition of sock_____ Brand/Model_____

n. On average how often do you replace the shoes you use for practices, rehearsals, or performances?

- ◯ 1–6 months
- ◯ 1–1.5 years
- ◯ 2–3 years
- ◯ 7–12 months
- ◯ 1.6–2 years
- ◯ more than 3 years

o. After wearing the Bates Durashocks shoes for one year, how often would you say it needs to be replaced?

- ◯ 1–3 months
- ◯ 7–9 months
- ◯ >1 year
- ◯ 4–6 months
- ◯ 1 year

p. Other comments on Bates Durashocks?

_____

_____

_____

7. UNIFORMS. Did you have any problems with the uniforms you wore for performances in the last year?

- ◯ No
- ◯ Yes. If Yes, what are the problems?

_____

_____

EXERCISE AND SPORTS

8. AEROBIC EXERCISE

a. How many days per week did you perform aerobic exercise (running, cycling, swimming, etc.) in the last year, **on average**?

◯ None	◯ 2 days/wk	◯ 5 days/wk
◯ Less than 1 day/wk	◯ 3 days/wk	◯ 6 days/wk
◯ 1 day/wk	◯ 4 days/wk	◯ 7 days/wk

b. On days when you performed aerobic exercise (running, cycling, swimming, etc.) in the last year, how long did you exercise, **on average**?

◯ None	◯ 15–30 min	◯ 46–60 min
◯ Less than 15 min	◯ 31–45 min	◯ More than 60 min

9. STRENGTH TRAINING

a. How many days per week did you exercise to improve your strength (free weights, universal, nautilus, push-ups, sit-ups, etc.) in the last year, **on average**?

◯ None	◯ 2 days/wk	◯ 5 days/wk
◯ Less than 1 day/wk	◯ 3 days/wk	◯ 6 days/wk
◯ 1 day/wk	◯ 4 days/wk	◯ 7 days/wk

b. On days when you exercised to improve your strength (free weights, universal, nautilus, push-ups, sit-ups, etc.) in the last year, how long did you exercise, **on average**?

◯ None	◯ 15–30 min	◯ 46–60 min
◯ Less than 15 min	◯ 31–45 min	◯ More than 60 min

10. SPORTS ACTIVITY

a. How many days per week did you participate in sports activities in the last year, **on average**?

◯ None	◯ 2 days/wk	◯ 5 days/wk
◯ Less than 1 day/wk	◯ 3 days/wk	◯ 6 days/wk
◯ 1 day/wk	◯ 4 days/wk	◯ 7 days/wk

b. On days that you participated in sports activities in the last year, how long did you participate, **on average**?

- ◯ None
- ◯ Less than 15 min
- ◯ 15–30 min
- ◯ 31–45 min
- ◯ 46–60 min
- ◯ 61–90 min (1–1.5 hours)
- ◯ 91–120 min (1.5 to 2 hours
- ◯ 121–150 min (2–2.5 hours)
- ◯ More than 150 min (more than 2.5 hours)

11. OTHER PHYSICAL ACTIVITY

a. How many days per week did you perform other physical activity (like gardening, home repair, hunting, fishing, wood cutting, etc.) in the last year, **on average**?

- ◯ None
- ◯ Less than 1 day/wk
- ◯ 1 day/wk
- ◯ 2 days/wk
- ◯ 3 days/wk
- ◯ 4 days/wk
- ◯ 5 days/wk
- ◯ 6 days/wk
- ◯ 7 days/wk

b. On days that you performed other physical activity (like gardening, home repair, hunting, fishing, wood cutting, etc.) in the last year, how long did you participate, **on average**?

- ◯ None
- ◯ Less than 15 min
- ◯ 15–30 min
- ◯ 31–45 min
- ◯ 46–60 min
- ◯ 61–120 min (1–2 hours)
- ◯ 121–180 min (2–3 hours)
- ◯ 181–240 min (3–4 hours)
- ◯ 241–300 min (4–5 hours)
- ◯ More than 300 min (more than 5 hours)

12. OVERALL PHYSICAL ACTIVITY. Overall, how would you rate yourself as to the amount of physical activity you perform, compared to others of your age and sex?

- ◯ Much more active
- ◯ Somewhat more active
- ◯ About the same
- ◯ Somewhat less active
- ◯ Much less active

TOBACCO USE

13. SMOKING: Which statement best describes your smoking habits in the last year?

- ○ I have never been a smoker
- ○ I smoked but quit → ○ I quit less than 6 months ago
- ○ I smoke 10 or fewer cigarettes per day ○ I quit 6 months to 1 year ago
- ○ I smoke 11 to 20 cigarettes per day ○ I quit more than a year ago
- ○ I smoke more than 20 cigarettes per day

14. SMOKELESS TOBACCO: What statement best describes your use of smokeless tobacco (chewing, dipping or pinching) in the last year?

- ○ I have never used smokeless tobacco
- ○ I used smokeless tobacco but quit → ○ I quit less than 6 months ago
- ○ I use smokeless tobacco one time per day or less ○ I quit 6 months to 1 year ago
- ○ I use smokeless tobacco 2-4 times per day ○ I quit more than a year ago
- ○ I use smokeless tobacco 5-10 times per day
- ○ I use smokeless tobacco more than 10 times per day

MEDICAL PROBLEMS AND MEDICAL CARE

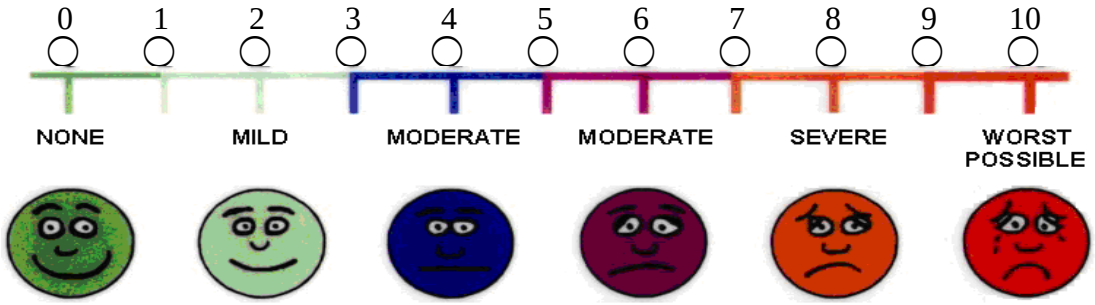
15. PAIN WHILE SINGING/DANCING. Did you have pain, soreness, discomfort, weakness, numbness, or tingling while rehearsing, practicing, and/or performing in the last year?

- ○ No (If no, go to Question 19)
- ○ Yes.

a. If yes, in what part of your body did you experience **the most** pain, soreness, discomfort, weakness, numbness, or tingling while practicing or performing?

_____

b. If yes, grade the pain, soreness, discomfort, weakness, numbness, or tingling for this part of your body.



16. PAIN WHILE SINGING/DANCING. Is there a **second part of your body** where you had pain, soreness, discomfort, weakness, numbness, or tingling while rehearsing, practicing, or performing within the last year?

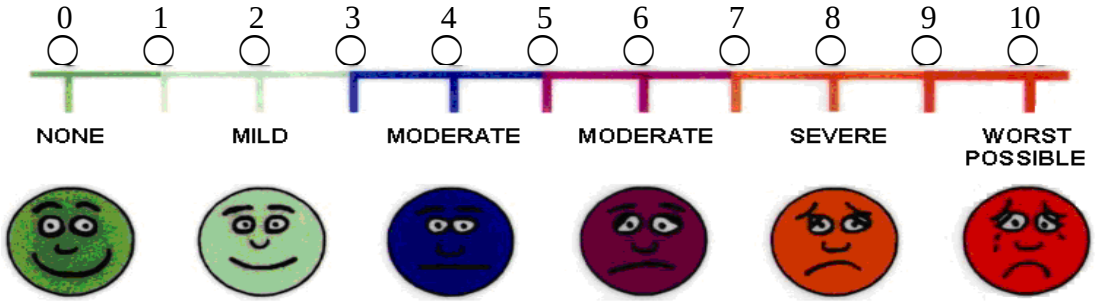
○ No (If no, go to Question 19)

○ Yes.

a. If yes, what is this second part of your body where you experienced pain, soreness, discomfort, weakness, numbness, or tingling?

_____

b. If yes, grade the pain, soreness, discomfort, weakness, numbness, or tingling for this part of your body (circle a number).



17. PAIN WHILE SINGING/DANCING. Are there other parts of your body where you experienced pain, soreness, discomfort, weakness, numbness, or tingling when rehearsing, practicing, or performing within the last year?

- ◯ No
- ◯ Yes

18. CHANGES DUE TO PAIN. Did pain, soreness, discomfort, weakness, numbness, or tingling ever cause you to modify the way you sang or danced within the last year?

- ◯ Unsure
- ◯ No
- ◯ Yes If yes, how did you modify your singing or dancing?

_____

19. FOOT PROBLEMS: Did you have foot pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

20. KNEE PROBLEMS: Did you have knee pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

21. BACK PROBLEMS: Did you have back pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

22. SHOULDER PROBLEMS: Did you have shoulder pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

23. NECK PROBLEMS: Did you have neck pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

24. WRIST PROBLEMS: Did you have wrist pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

25. HAND/FINGER PROBLEMS: Did you have hand or finger pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

26. DENTAL PROBLEMS: Did you have problems with your teeth, jaws or embouchure (lips and tongue) that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

27. VOCAL PROBLEMS: Did you have vocal pain, soreness, discomfort, weakness, numbness, or tingling that caused you to limit your **daily activity** some times within the last year?

- ◯ No
- ◯ Yes If yes, was this caused by your participation in Band activities?
  - ◯ No
  - ◯ Yes
  - ◯ Unsure

28. INJURIES YOU HAVE HAD. Injuries include acute injuries (those that are sudden and unexpected) as well as overuse injuries (those involving pain that develops over time and might be chronic or recurrent). Did you have one or more injuries in the last year **related to singing or dancing** (whether or not you sought medical care for these injuries)?

- ◯ No (If no, go to Question 30)
- ◯ Yes

29. INJURIES: If you had an injury within the last year **related to singing or dancing**, complete the information below. If you had more than one injury to a particular body part, list only the most serious one.

	Injured				
Body Part	**NO**	**YES**	**Type of Injury**	**Cause of injury**	**Days of Limited Duty (profile), if any**
Vocal Cords	○	○	_____	_____	_____
Teeth/Jaws	○	○	_____	_____	_____
Head	○	○	_____	_____	_____
Neck	○	○	_____	_____	_____
Shoulders	○	○	_____	_____	_____
Upper Arm	○	○	_____	_____	_____
Lower Arm	○	○	_____	_____	_____
Wrist	○	○	_____	_____	_____
Hand	○	○	_____	_____	_____
Fingers	○	○	_____	_____	_____
Chest	○	○	_____	_____	_____
Upper Back	○	○	_____	_____	_____
Lower Back	○	○	_____	_____	_____
Abdomen	○	○	_____	_____	_____
Hip	○	○	_____	_____	_____
Thigh	○	○	_____	_____	_____
Knee	○	○	_____	_____	_____
Calf/Shin	○	○	_____	_____	_____
Ankle	○	○	_____	_____	_____
Foot	○	○	_____	_____	_____
Toes	○	○	_____	_____	_____

30. HEALTH CARE FACILITY. Where do you usually get your medical care?

- ◯ Rader Health Clinic (Ft Myer)
- ◯ Walter Reed Army Medical Center
- ◯ DeWitt Army Community Hospital (Ft Belvior)
- ◯ Other military medical facility. Name: _____
- ◯ Civilian medical facility. Name: _____

31. SATISFACTION WITH MEDICAL CARE. How satisfied are you with the quality of the medical care you have received at the medical facility?

- ◯ Completely satisfied
- ◯ Reasonably satisfied
- ◯ Borderline
- ◯ Moderately unsatisfied
- ◯ Extremely unsatisfied

32. CHANGES YOU WOULD RECOMMEND. To reduce the possibility of injury, what two aspects of your job would you change (if any)?

1. _____
2. _____

HEARING

33. To what degree are you concerned about hearing loss from what you do in the U.S. Army Band?

- ◯ Extremely concerned
- ◯ Very concerned
- ◯ Somewhat concerned
- ◯ A little unconcerned
- ◯ Not concerned

34. Do you take more than one aspirin a day on a fairly regular basis?
    - ◯ No
    - ◯ Yes

35. Do you use hearing protection during practice sessions?
    - ◯ Never
    - ◯ Sometimes
    - ◯ Always

36. Do you use hearing protection during rehearsals?
    - ◯ Never
    - ◯ Sometimes
    - ◯ Always

37. Do you use hearing protection during performances?
    - ◯ Never
    - ◯ Sometimes
    - ◯ Always

38. Would you use a hearing protector that not only protected your hearing, but also enhanced your ability to hear others and monitor your performance?
    - ◯ No
    - ◯ Yes

ADDITIONAL COMMENTS

39. Provide any additional comments or thoughts you have.

_____

_____

_____

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